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AIRPLANES MUST BE SAFE

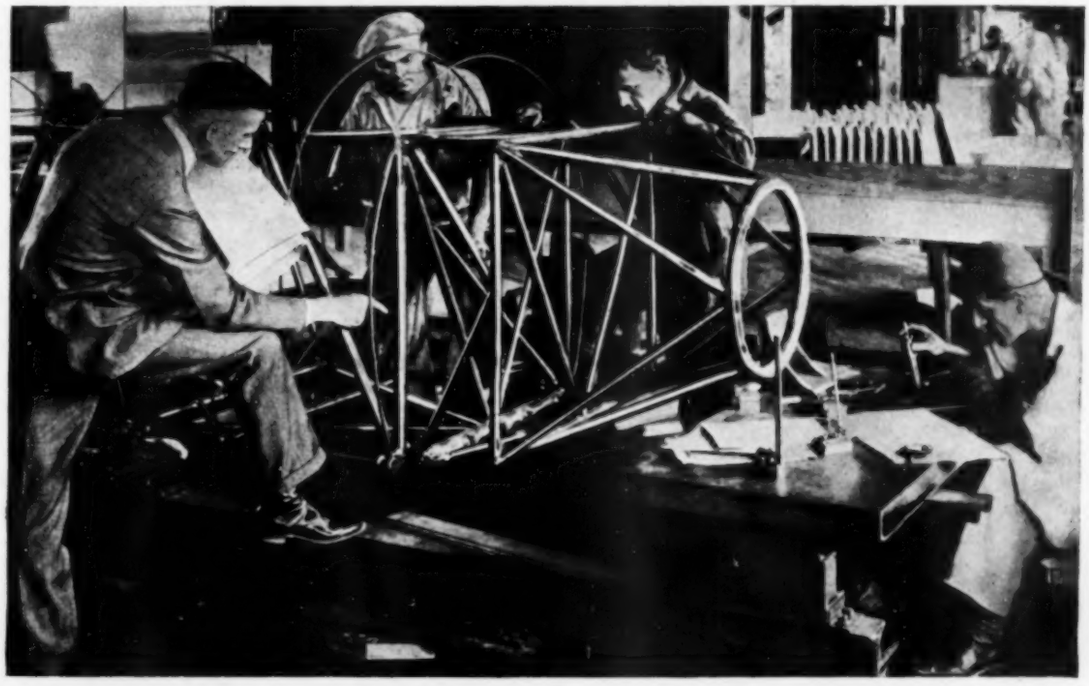
A resumé of one plant's standards for materials testing and final inspection

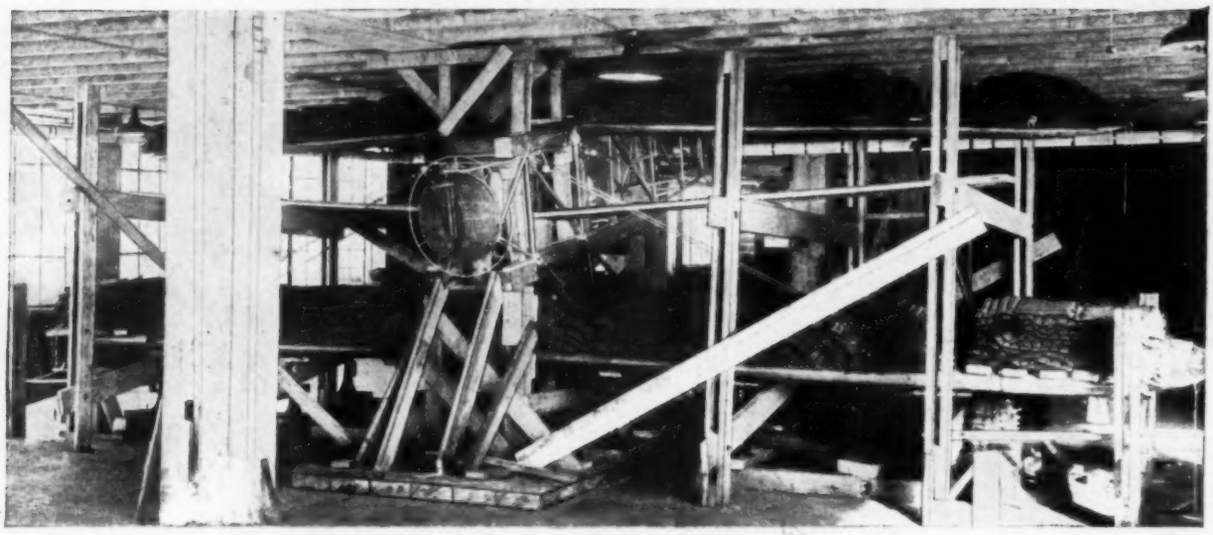
Robert E. Johnson
Boeing Companies

"IS THIS airplane safe?" that is the question uppermost in the minds of those who step into a plane for their first trip into the air. It is also uppermost in the attitude of the Department of Commerce toward flying in the United States. In consequence, the government has developed a rigid code of requirements which must be satisfied by those constructing and operating airplanes.

The Boeing plant at Seattle, Washington, one of the largest factories for airplane manufacture, affords a good example for a study of inspection methods in aircraft production, for this plant is largely self-contained. With the exception of engines, instruments, tires, and similar accessories, all parts entering into the assembly of a Boeing airplane are manufactured from raw stock at this plant.

Alignment checking of the fuselage is done on this heavy jig





Weight tests on wings of Boeing planes are made by piling weighed bags of shot on the wings while the plane is held in the scaffolding shown

Roughly, inspection falls within two classifications: commercial and military. As this factory is an important producer of military aircraft, both the Army and Navy maintain representatives at the factory to inspect the construction of military planes. The company also employs a large staff of trained inspectors. Both branches of inspection are rather closely related, inasmuch as all parts used in military planes are inspected by both military and company staffs. In commercial planes military requirements are strictly adhered to and the inspection methods are conducted accordingly.

As soon as purchased materials arrive at the factory samples are referred to the inspection staff, which checks the material for quality specified in the purchase order. Material that requires detailed testing for physical and chemical characteristics is bonded in the warehouse and samples are referred to the testing department for examination. If the results of the tests are satisfactory the material is accepted and approved for production purposes. Sub-standard material is rejected and returned to its source with an explanation of its deficiency. This preliminary phase of the inspection work is of vital importance, as material entering into the production of airplanes must be of finest grade.

Inspection of the various phases of manufacture is allocated through members of the inspection staff who are particularly familiar with the respective types of work. John Wilson, chief inspector, has found that the best inspector is one who has been previously employed in one of the production units of the factory. This type of inspector is thoroughly trained in the type of manufacture and the shop practices.

All component parts of Boeing airplanes produced in the machine shop are routed through the metal inspection department. Accompanying the parts are shop orders specifically stating the type of work, and also detailed drawings furnished by the engineering department. Precision instruments are used by those who check the dimensions and quality of workmanship of the parts against the requirements and drawings. Any part deviating however slightly from the specifications is flatly rejected.

In the sheet-metal department, where such parts as cowlings, tail surfaces, ailerons, and flooring are produced from flat stock, the use of templets is necessary. Therefore, the inspector must approve the templet and a sample part produced therefrom before further work can be conducted.

Steel parts fabricated in the machine shop are usually subjected to heat-treatment in electric furnaces. The inspector charged with the supervision of this portion of the work not only examines the heat-treated parts, but checks frequently the temperatures of the furnaces to insure accuracy in the treatment. Furnace temperatures are recorded by automatic pyrometers, and a record of every heating operation is kept.

Sheet-metal parts fabricated of aluminum alloys are tempered by treatment in potassium and sodium nitrate solutions brought to a temperature of 950 deg. F. Samples of this work are referred to the testing engineer with a record of the solution temperature. Every finished steel or aluminum alloy part which undergoes heat-treatment is tested for hardness in a Rockwell machine to ensure complete satisfaction of requirements.

In sub-assembly work, such as the construction of fuselages, the use of jigs is necessary and these must be closely examined by the inspection staff to insure dimensional accuracy in the fuselage assembly. After the fuselage has been completely assembled it is removed from the assembly jig and placed on an alignment jig, where a final inspection of the assembly is conducted. Even a slight dimensional variation in a fuselage constitutes cause for rejection or for a re-working order by inspectors.

Lumber is inspected at its source of supply by government men and is purchased by the Boeing plant upon their recommendation, but a trained woodworker is stationed in the wood department to oversee the production of such wooden parts as wing beams, spars, and ribs.

Structural members manufactured from steel tubing, the ends of which have been closed, are protected from corrosion by the application of a coating of oil on the inside. Through a special opening, heated oil is forced in until the entire tubing has been covered. Hot oil is

BOEING MATERIAL SPECIFICATIONS

Material	Chemical Requirements (all figures in per cent)	Physical Requirements: Ten. Str. Lb. per Sq.In.	Physical Requirements: Elong. Per Cent in 2 in.
Aluminum Alloy Castings	Cu 4.50, Fe 0.80, Si 0.80, Al Bal. (typical)	28,000 (min.) (heat treated)	6 (min).
Magnesium Alloy Castings	Al 7.0, Mn 0.4, Mag 92.6	29,000 (min.) (heat treated)	6 (min).
Bar Steel (S. A. E. 1020)	C 0.15-0.25, Mn 0.30-0.60, P 0.045 (max.), S 0.050 (max.), Si 0.15-0.35	.....	....
Bar Steel (S. A. E. 1025)	C 0.20-0.30, Mn 0.50-0.80, P 0.045 (max.), S 0.050 (max.), Si 0.15-0.35	55,000 (min.)	22
Bar Steel (S. A. E. 2330)	C 0.25-0.35, Mn 0.50-0.80, P 0.40 (max.), Si 0.15-0.35, Ni 3.25-3.75, S 0.050 (max.)	125,000 (heat treated)	15
Bar Steel (S. A. E. 4130)	C 0.25-0.35, Mn 0.40-0.70, P 0.40 max.), Si 0.15-0.35, S 0.045 (max.), Cr 0.50-0.80, Mo 0.15-0.25	125,000 (heat treated)	18
Sheet Steel (S. A. E. 1095)	C 0.90-1.05, Mn 0.25-0.50, P 0.040 (max.), S 0.045, (max.)	.....	....
Sheet Steel (S. A. E. 1025)	C 0.20-0.30, Mn 0.50-0.80, P 0.045 (max.), S 0.050 (max.)	55,000	22
Sheet Steel (X-4130)	C 0.25-0.35, Mn 0.40-0.60, P 0.040 (max.), S 0.040 (max.), Cr 0.80-1.10, Mo 0.15-0.25	90,000	10–20
Aluminum Sheet	99 Pure Aluminum	12,500 (soft) 16,000 (H.H.) 22,000–28,000 hard)	15–30 5–7 4–2
Aluminum Rods, Bars, Shapes	99 Pure Aluminum	12,500–12,000 soft) 16,000–22,000 (H.H.)	18–25 6–5
Aluminum Alloys Rods, Bars, Shapes	Cu 3.5-4.5, Mag 0.20-0.75, Mn 0.4-1.0, Alum 92.0 (min.)	35,000 (max.) annealed)	16
Aluminum Alloy Rods, Bars, Shapes.	Cu 3.5-4.5, Mag 0.20-0.75, Mn 0.4-1.0, Alum 92.0 (min.)	50,000–55,000 heat reated)	12–18
Aluminum Alloy Plates, Sheets	Cu 3.5-4.5, Mag 0.20-0.75, Mn 0.4-1.0, Alum 92.0 (min.)	35,000 (max.) (annealed)	8–12
Aluminum Alloy Plates, Sheets	Cu 3.5-4.5, Mag 0.20-0.75, Mn 0.4-1.0, Alum 92.0 (min.)	50,000–55,000 (heat treated)	7–15
Aluminum Alloy Forgings	Cu 3.5-4.5, Mag 0.20-0.75, Mn 0.4-1.0, Alum 92.0 (min.)	55,000	16
Brass Bars, Shapes (Commercial)	Cu 60.0-63.0, Pb 2.25-3.25, Iron 0.10 (max.) Impurities 0.25, Zinc remainder	40,000–48,000 (Soft)	30–20
Brass Bars, Shapes (Commercial)	Cu 60.0-63.0, Pb 2.25-3.25, Iron 0.10 (max.) Impurities 0.25, Zinc remainder	45,000–57,000 (H. H.)	25–10
Brass Plates, Sheet, Stripe (Commercial)	Cu 64.5-67,5, Pb 0-0.3 Iron 0.05 (max.), Impurities 0.10 (max.) Zinc remainder	40,000 (soft) 52,500 (H.H.) 67,500 (hard)	42 15 5
Brass Rods, Bars (Naval)	Cu 59.0-62.0, Tin 0.5-1.5, Iron 0.10 (max.), Pb 0.30 (max.), Impurities 0.10 (max.)	50,000-54,000 (soft)	40–30
Brass Rods, Bars (Naval)	Cu 59.0-62.0, Tin 0.5-1.5, Iron 0.10 (max.) Pb 0.30 (max.), Impurities 0.10 (max.), Zinc remainder	54,000–60,000 (H.H.)	35–25
Brass Rods, Bars (Naval)	Cu 59.0-62.0, Tin 0.5-1.5, Iron 0.10 (max.), Pb 0.30 (max.), Impurities 0.10 (max.), Zinc remainder	54,000–67,000 (hard)	30–22
Brass Sheet (Naval)	Cu 59.0-62.0, Tin 0.5-1.5, Iron 0.10 (max.), Pb 0.30 (max.), Impurities 0.10 (max.), Zinc remainder	50,000 (soft)	20
Brass Sheet	Cu 59.0-62.0, Tin 0.5-1.5, Iron 0.10 (max.), Pb 0.30 (max.), Impurities 0.10 (max.), Zinc remainder	60,000 (H.H)	15
Steel Tubing (S. A. E. 1025)	C 0.20-0.30, Mn 0.50-0.80, P 0.045 max.) S 0.050 (max.)	55,000	22
Steel Tubing (S. A. E. 4130)	C 0.25-0.35, Mn 0.40-0.60, P 0.040 (max.), S 0.045 (max.), Cr 0.80-1.10, Mo 0.15-0.25	95,000	10
Aluminum Tubing	99 Pure Aluminum	16,000 (H.H.)	4
Aluminum Alloy Tubing	(See aluminum alloy rods, bars)	55,000 (heat treated) 35,000 (annealed)	14–18

NOTE:—S.A.E. designations apply to material similar to commercial material, but with aircraft inspection.

Finished Parts Tests

FLAT-HEAD PINS (Aircraft)—Sample for test selected at random from each lot of 200 or fraction. Tested in single shear. Required unit shear stress = 80,000 lb.

TURNBUCKLES—At least 2 per cent of all turnbuckles are tested. The test specimens must meet ultimate strength requirements as follows:

6-40, 800 lb.; 10-32, 1,600 lb.; 12-28, 2,100 lb.; $\frac{1}{4}$-28, 3,200 lb.; $\frac{5}{16}$-24, 4,600 lb.; $\frac{3}{8}$-24, 6,100 lb.; $\frac{7}{16}$-24, 8,000 lb.; $\frac{1}{2}$-20, 12,500 lb.; $\frac{9}{16}$-20, 17,500 lb.

Each turnbuckle shank which meets tensile test without failure must withstand 90 deg. bend test over square jawed vice without cracking.

TIEROD CLEVIS (Aircraft)—At least two per cent of all clevises are given tensile and bend test before acceptance. Test Specimens must meet ultimate strength requirements as follows:

6-40, 1,000 lb.; 10-32, 2,100 lb.; $\frac{1}{4}$-28, 3,400 lb.; $\frac{5}{16}$-24, 4,600 lb.; $\frac{3}{8}$-24, 6,100 lb.; $\frac{7}{16}$-24, 8,000 lb.; $\frac{1}{2}$-20, 11,500 lb.; $\frac{9}{16}$-20, 15,500 lb.; $\frac{5}{8}$-18, 20,200 lb.; $\frac{3}{4}$-18, 24,700 lb. The unbroken clevis fork must withstand 45 deg. bend, opening up, without cracking.

SHACKLES (Cable)—One per cent of each size shackle given tensile test before acceptance. Test specimens must meet ultimate strength requirements. One per cent must withstand opening and bending flat without cracking.

BOLTS (Aircraft)—One bolt for tensile or shear test and one for bend test from each lot of 200 or less must meet ultimate strength requirements before acceptance.

Required unit tensile stress = 125,000 lb. per sq.in.

Required unit shear stress = 80,000 lb. per sq.in.

Bolts must withstand bending 180 deg. over a diameter equal to diameter of the bolt.

TIERODS—Two per cent of all tierods are given tensile and bend test. Ultimate strength requirements:

6-40, 1,000 lb.; 10-32, 2,100 lb.; $\frac{1}{4}$-28, 3,400 lb.; $\frac{5}{16}$-24, 6,100 lb.; $\frac{3}{8}$-24, 8,000 lb.; $\frac{7}{16}$-20, 11,500 lb.; $\frac{1}{2}$-20, 15,500 lb. Test wires must stand a minimum of nine 90 deg. bends over a radius three times the minor axis of rod.

Proof Tests

(Proof testing does not destroy the part tested or prevent it being used. The following parts are proof tested one hundred per cent before final assembly:)

LANDING GEAR AXLES—All axles are proof loaded by a bend test which stresses the material to approximately ninety per cent of the design yield point.

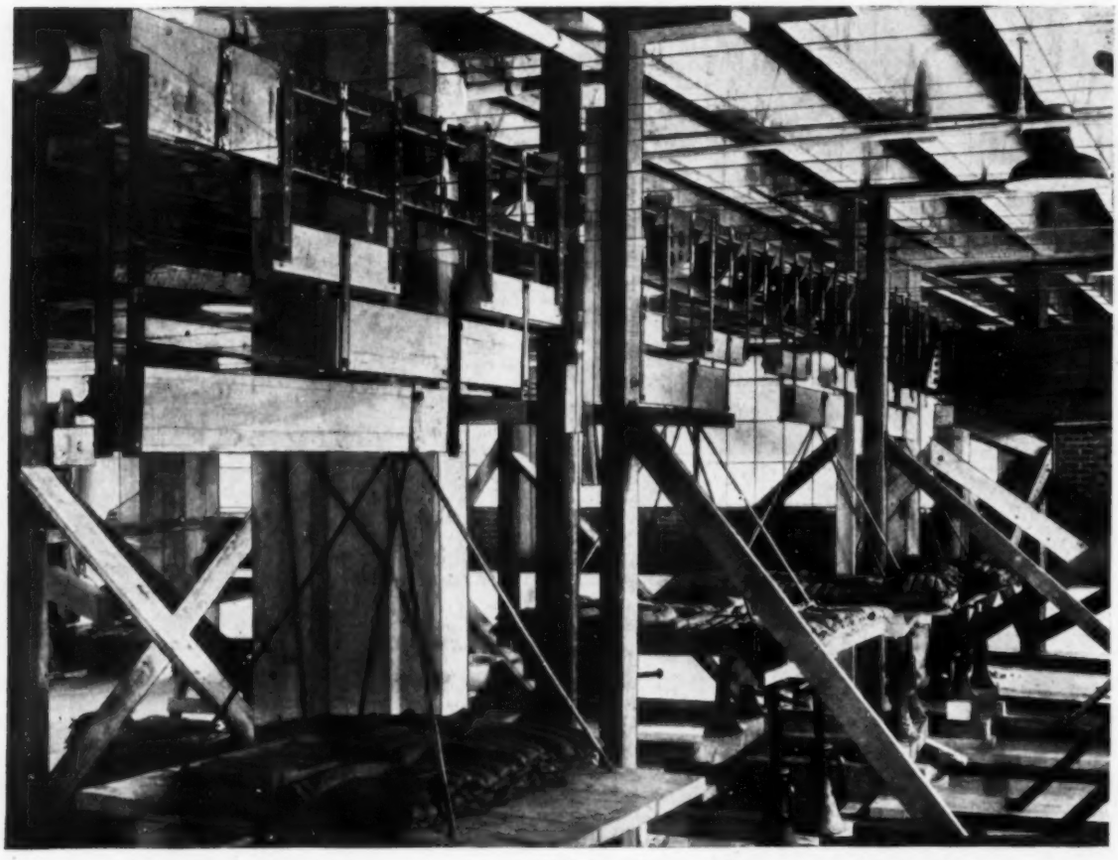
OLEO CYLINDERS—Oleo cylinders are tested to 6,000 lb. per sq.in. hydro-static pressure.

CONTROL CABLES—After all splicing operations are completed the cables are loaded to sixty per cent of the rated strength.

OLEO SPRINGS—Ten per cent of all oleo springs are tested and examined by cutting and etching to determine conformity with design data.

Structures and Installations

Static testing of structures such as fuselages, wings, wing spars, wing ribs, wing leading edge, stabilizer and elevator, rudder and fin, also surface control systems, is common practice in the case of experimental design. With the exception of wing ribs and control surfaces, the other structures noted yield to mathematical analysis and hence tests to destruction are not considered essential except in case of unconventional design.



Test of a completed Duralumin spar. The linkage shown is used to apply the weight uniformly to comply with actual pressure conditions in flight. Shot bags are added gradually until the theoretical strength factor is reached. Some spars are tested to destruction, the weight being increased gradually until failure occurs

used so that the inspector can determine, by his sense of touch, when the inside of entire structure has been covered.

To protect Duralumin parts of Navy planes against corrosion, structural members are anodized. The oxide produced forms a base for the subsequent coating of red oxide primer. Steel parts are electro-plated with cadmium to prevent corrosion.

In the enameling department the finishes are baked in an electric oven, and it is the duty of the inspector supervising this work to check closely the oven temperatures, as excessive heat will injure the temper of the metal.

A majority of the wings for Boeing military and commercial airplanes are constructed of wood, covered with the finest mercerized cotton airplane cloth, applied by skilled seamstresses working under inspectors who check the number of stitches and knots as well as their correctness.

After covering, the wings receive several coats of dope. Between coats, the wing surfaces are water-rubbed with fine sandpaper, and the inspection department must supervise this operation closely, as excessive rubbing thins the coat and may injure the fabric.

All manufacturing operations are conducted under the active supervision of the inspection staff, and the shop order, which accompanies each part through the various stages of its manufacture, serves as the inspection record, for the inspector must indicate his approval on this record.

Identification of parts is facilitated by a series of varicolored inspection tags, indicating "acceptance," "rejection," "further work required," or "hold for further inspection." No parts or units may be used in the assembly of a plane unless they carry acceptance tags, dated and signed by the inspector. Metals also are designated by a system of color marking, and corresponding key charts are prominently displayed.

Ordinarily, rejected parts are scrapped unless there is a question regarding the acceptability of a unit, in which case it is sent to the salvage department to be stored for possible later use. Salvaged parts must be passed upon by a committee composed of the chief inspector, the chief engineer of the company, the superintendent of the factory, and a representative of the purchaser.

A detailed inspection record is made during the final assembly of planes, every operation involved being closely checked. Fifty-four items require the inspector's attention in the installation of the engine alone.

When the plane has been completely assembled except for installation of the wings and the rigging, which is conducted at the nearby airport, the ship is released to the hangar. There the wings are attached and rigged. The inspector then examines the completed product, and if satisfactory, signifies his approval of the airplane for testing. This final inspection is extremely detailed. Every part of the airplane is thoroughly examined, and engines and instruments are tested. When the test pilot climbs into the cockpit he knows the ship is "right."

Practical Hole Tolerances

Discussion

W. G. HOLMES

Unless adequate clearance is allowed, the tool will freeze to the bushing, causing breakage

APPARENTLY, the unilateral, bilateral, and uni-bilateral hole tolerance systems were rejected by the General Motors tool standards sub-committee because they do not permit all classes of holes of one nominal diameter to be produced by a single size of reamer. These former systems were devised to provide a definite tolerance for each class of hole, thereby establishing a logical basis for standard fits. It is true that the limits contained in each of these plans require a separate set of reamers for each class of holes. But it will be shown that the limits for holes, reamers, bushings, and plug gages set up as described by Mr. Ovaitt involve the defects inherent in the other systems; and that no system can be formulated wherein one size of reamer may be selected for a nominal hole size under all working conditions which arise in manufacturing practice.

For a great majority of the parts made in modern shops, a tolerance of 0.0010 in. in reamed holes is considered a high standard of workmanship. To obtain work with this tolerance the machine, fixture bushings, and reamers must be in excellent condition; in particular, the reamer requirements are most exacting. Many reamed holes do not require a tolerance closer than 0.0020 in. which permits of more latitude in tool requirements. When only 0.0010 is allowed for the hole size, the tolerance is entirely taken up by the two variables, reamer diameter when new and oversize cutting of the reamer.

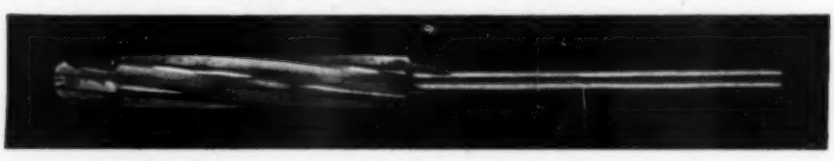
Many reamed holes are bell-mouthed, tapered, or out-of-round and are still sufficiently accurate to fill their intended purposes. If for all materials and conditions, reamers are held to an oversize cut of 0.0005 in., the tool expense will be excessive. Standardization must recognize all possible conditions and not a superfine condition where overcutting is limited to 0.0005 in. If oversize cut is to be made the basis, one should utilize the maximum variation from the nominal size rather than the average of 0.0005 in. or the 0.0007 in. limit within which the majority of holes fall. The greatest oversize cut of the largest reamer considered then becomes the standard diameter set for the maximum hole size.

The tool shown in the General Motors table of standard reamers (Vol. 72, page 904) is a rose reamer with special relief which cuts on the end only. The cylindrical lands on the outside diameter provide means for supporting and locating the end teeth but have not sufficient rake to do any real cutting. All the hole sizing is done at the extreme end, and when the corners are worn smaller than the body of the reamer, binding results. This will mar the hole finish, interfere with correct size cutting, and eventually destroy the tool. To avoid these effects, the reamer must be sharpened by grinding back the corners to the maximum reamer diameter. The central portion must be left as it carries the center used when sharpening. Repeated grindings form a shank at the end of the reamer which appreciably decreases its value for salvage purposes. The life of tools of this type is dependent on reduction in length rather than reduction in diameter, so the use of the tolerance system described will have little effect on tool economy.

Where a hole with 0.0005-in. limit is required, the only practical production method is a rereaming operation using a reamer with a beveled lead such as is found on hand reamers and with also a similar flute. Then no cylindrical land is left to bind and roughen the finish of the hole. For rose reamers, there is hardly a need for listing a Class 6 hole tolerance as the manufacturing difficulties are too severe.

It is further proposed in the General Motors system to use the nominal diameter of a given hole size as the maximum for reamers and drills and as the minimum for the bushings to be used with these tols. This makes it possible to have the bushing diameter the same size as that of the drill or reamer. Since some clearance between the bushing and reamer is needed, it is necessary to lap out the bushing when the minimum bushing size and maximum reamer size are used together. This is especially true in the larger sizes as the wider drill and reamer lands require greater clearance. The heating of a tool in severe service may cause an expansion of as much as 0.0010 in. for a $\frac{3}{8}$-in. drill which is another reason for adequate bushing clearance. The accompanying illustration shows the result of an attempt to use a drill and bushing under these conditions. So it may be concluded that the maximum standard tool diameter as fixed is too large, or the minimum bushing bore is too small for a large class of ordinary machine work.

Repeated grindings reduce the effective length of rose reamers which usually determines their life



In Vol. 72, pages 903 and 956, D. W. Ovaitt described a system of hole, reamer, and plug gage tolerances devised and adopted by General Motors. Another article "Practical Hole Tolerances" (Vol. 74, page 316) by the same author enlarged on the original presentation.

NEW BOOKS

DETAILING AND FABRICATING STRUCTURAL STEEL—*(Second Edition). By F. W. Dencer, Assistant Division Engineer, American Bridge Company. 441 pages, 5¾x9 in. Illustrated. Indexed. Clothboard covers. Published by the McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York, N. Y. Price $5.00.*

Great changes have occurred in structural practice within the past several years, changes which have necessitated the rewriting of this six-year-old text. The scope of this standard work includes discussions of engineering and shop organizations, structural designs and specifications, handling contracts, ordering material, making shop drawings, fabricating, inspecting, and shipping steel. Practices of various structural shop departments are described in detail, but tables and data usually found in handbooks is omitted. Two appendixes, one a classification of structures, the other a glossary of structural shop terms, are decidedly valuable. Some 281 illustrations serve to clarify the text.

This volume, which was translated into German as representative of American practice, is clear, concise, and well presented. The original material has been extensively revised, new material has been added, many new drawings have been made, and the book entirely reset in order to record recent progress. This is not a detail manual so much as a careful, practical survey.

MECHANICAL WORLD YEAR BOOK, 1931—*358 pages, 4x6 in. Cloth board covers. Indexed. Published by Emmott & Co., Ltd., Manchester, England. Price 1s. 6d. net.*

This is the forty-fourth year in which this useful little volume has been published. Edited primarily for British use, it contains a wide variety of information in many fields that include steam engineering, electricity, and machine shop work. It is an excellent reference book, the price being made possible by the many pages of advertising. It also contains a diary for the year.

DIE GRUNDLAGEN DER CONSTRUCTION (PRINCIPLES OF MANUFACTURE)—*Edited by Dipl.-Ing. A. Erkens, Berlin, Germany. 39 pages, 8¼x11⅝ in. Paper covers. Illustrated. Published by Beuth Verlag GMBH, Berlin S14, Germany.*

One of the series of VDI papers on "Group Construction," or mass production, this particular paper gives principles of manufacture with practical examples. This pamphlet is a development of the decision of VDI in 1927 to give practical courses for designers, and covers the material on connecting rods given in the first course, discussing stress determination, machining, finishing, and assembling. Contents are in the nature of data sheets, well illustrated. The book is entirely in German.

ENGINEERING METALLURGY—*(Second Edition). By Bradley Stoughton and Allison Butts, Professor and Associate Professor of Metallurgy, Lehigh University. 498 pages, 5¾ x 9 in. 200 illustrations. 44 tables. Indexed. Clothboard covers. Published by the McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York, N. Y. Price $4.00.*

This second edition presents the principles and practices of metallurgy from the standpoint of their importance to the user of metals and alloys. It is revised and enlarged to cover the advances of the past four years in the physical and mechanical phases of the subject, particularly of alloys, alloy steels, heat-treatment of steel and non-ferrous alloys, and welding. Many new illustrations and diagrams have been added, and technical information and statistics have been brought up to date.

Planned principally as an introductory text for engineering schools desiring a concise presentation, this volume is nevertheless a welcome addition to the bookshelf of the executive or engineer, particularly the one who feels himself weak on the increasingly important metallurgical side of the picture. While introductory, it is neither elementary, pedantic, nor collegiate.

PLANT LOCATION—*By Gerald Holmes, Industrial Engineer, 275 pages, 5¾x9 in. Indexed. Illustrated. Clothboard covers. Published by the McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York, N. Y. Price $3.00.*

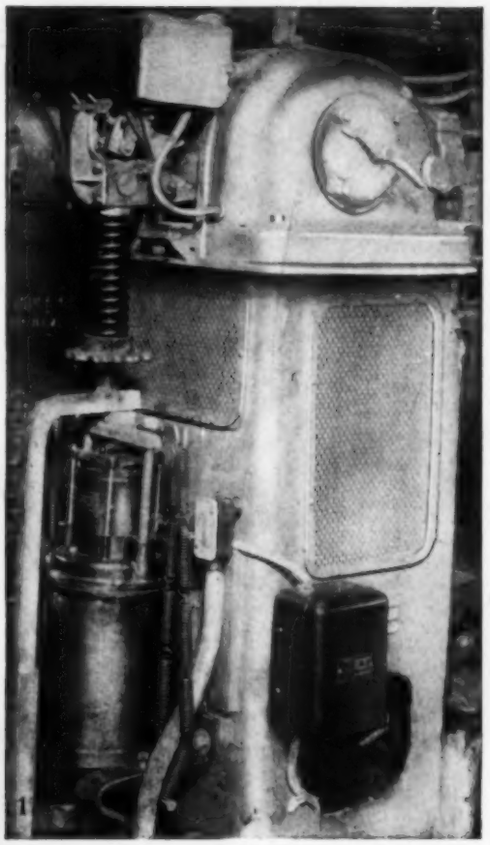
Superficially, these days of comparatively limited industrial expansion may not appear an opportune time for a study on plant location. But when manufacturing economies are in order, no phase of production should be neglected. Unless one has given the subject some serious thought, he will have little concept of the many factors which hinge on the suitable selection of a manufacturing site. The advantages of one location over another may be sufficient to make the heavy expense of plant migration advisable.

The author treats his subject thoroughly and logically. He divides the study into three parts, "Choosing the General Territory," "Choosing the Particular Community," and "Choosing the Site." Proximity to the market and to sources of raw materials are important considerations. The cement industry for example has changed from dependence on specific rock formations to location near the market. Products such as ice cream and baked goods are necessarily made near the consumer, whereas paper mills and canneries remain near their raw material sources. Transportation facilities and freight rates are vital considerations. The latter subject is so complex that it comprises a separate study in itself. Fuel and power are controlling influences in many industries. Labor and wages contribute to the complexity of the problem. Laws and taxation are so varied that their effects must be carefully considered before deciding upon a site.

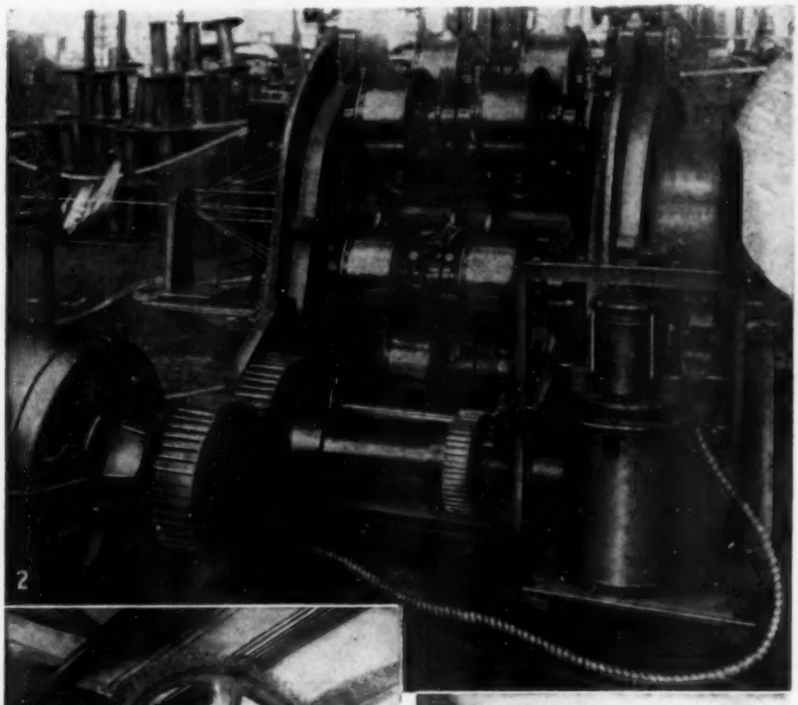
With our present narrow margin between manufacturing costs and selling price, all of the factors enumerated must be weighed before the final choice is made. Usually the decision will be a compromise between conflicting advantages and disadvantages. A poor selection may result through basing the conclusion on only one or two sides of the question.

An Electro-Hydraulic Operator

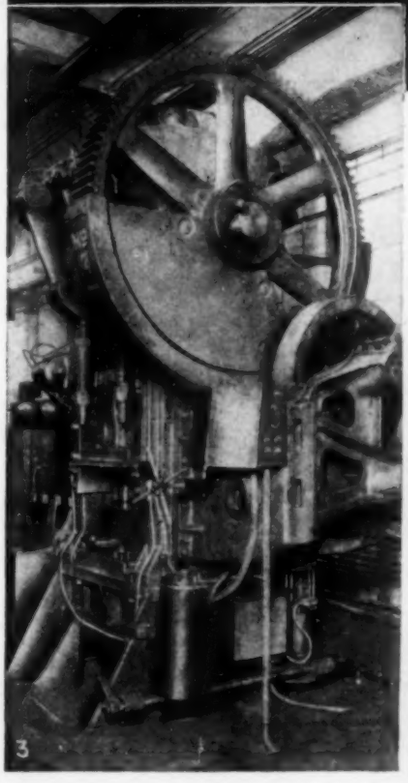
Photographs by courtesy of General Electric Company.



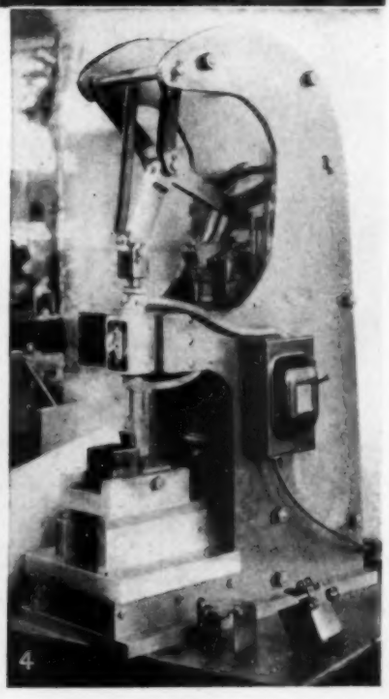
[1] The electro-hydraulic operator consists essentially of a piston exerting a smooth straight-line thrust in one direction through a definite distance. This is accomplished by driving a small oil-pump impeller with a fractional-horsepower motor, thus forcing the piston up by oil pressure. As long as the motor runs, the piston is held at the top of its stroke; when the power is interrupted, the piston falls. Uniform pressure is applied to all welds in this application of the device, built by General Electric



[2] Smooth stoppage of a machine, such as this wire strander, may be accomplished with the operator. It may be used similarly in setting brakes or stopping elevators



[3] The operator applied to a bench punch press. This type of installation can be used for any medium-pressure work, such as pressing in bushings and removing pins. The unit is portable, operates on standard circuits, and can apply pressure up to 5,000 lb.



[4] Applied to a 175-ton press, the unit operates the clutch rod, two series-connected push-buttons making certain the workman's hands are clear. Release of either button de-energizes the operator motor and sets the brake

EXECUTIVE FORUM

Free Advice

AN EFFICIENT workman is one without outside cares. Such was the belief of George Boyd, President of the Planet Engine Company, and he put his theory into practice. Planet employees were encouraged to unburden their troubles to company officials. Boyd did what he could to alleviate their difficulties and to restore the peace of mind of his men. One day this policy received an unexpected jolt.

"We're in a fine mess now," said Al Kendall, the Works Manager, as he entered Boyd's office. "You remember that scrape Joe Harris got himself into?"

"Why yes," said Boyd. "He told me about it some time ago. As I remember it, some girl was threatening to sue him for breach of promise. I gave him a letter to my lawyer so he could get some good legal advice. What's happenend now?"

"The girl made good on her threat," said Kendall. "The trial came off today and she got a judgment of five thousand dollars against Harris. Naturally he's wild. He says he'll get it out of the company for giving him poor advice."

"That can't be," said Boyd. "My lawyer knows his business."

"It really wasn't the lawyer's fault," said Kendall. "Harris told him only half the story. The lawyer advised that there was no case against him and no cause for worry. But this morning at the trial the evidence really came out, and Harris didn't have a leg to stand on."

"He certainly can't hold the company responsible" said Boyd. "If he didn't tell his story straight, he couldn't expect any other result."

"I know he can't collect from the company," said Kendall, "but he'll cause a lot of trouble. Harris is a good boring mill operator, but he likes to talk. This affair is going to get all over the shop. And every time Harris tells it, it will sound a little worse for the company. These yarns don't improve with age."

"What's to be done about it?" Boyd asked.

"Nothing," said Kendall, "unless we let Harris go. Then we're subject to criticism for adding to his troubles without just cause. My suggestion is to cut out all mixing in personal matters. Then these situations wouldn't arise."

"I can't agree with you," said Boyd. "I've been helping my men for a good many years, and a friendly hand at the right time has relieved a good deal of misery. You remember how we helped Daniels with his mortgage. Only a few men have received assistance ungraciously, and there's no reason why all the rest should suffer because of their conduct."

"One instance like this does the company more harm than ten good turns can remove," said Kendall. "If anything goes wrong, the company gets the brunt of the blame. After all it's not our business to pull these fellows out of their scrapes."

"Strictly speaking, perhaps not," said Boyd, "but men are more loyal when they know you'll stand back of them in a pinch. In his heart Harris knows he's wrong. After he cools off he'll settle down to work and forget about this suit."

"He can't forget it," said Kendall. "It'll take him five years to pay off the judgment. The worst of it is, he won't let anyone else forget it."

Suggested by Charles R. Whitehouse, Standards Engineer, The Holtzer-Cabot Electric Company.

■

What Do You Think About This Problem?

Employees frequently get into difficulties with which they feel unable to cope alone. A helping hand in time of trouble may restore their peace of mind and result in increased loyalty. However a policy of mixing in outside affairs may have extremely unpleasant reactions on the company. Does it pay to step beyond recognized business activities in an attempt to smooth out personal difficulties? Is there a way to aid employees and still avoid the danger of undesirable controversies?

. . . Discussion

of Executive Problems

■

Food for Thought

In determining the costs of running a lunchroom, the lunchroom should stand its share of overhead as do other departments. Only in this way can be secured the accurate cost of feeding the employees. To be ostrich-like and hide the true facts of costs from oneself is not conducive to efficient operation.

To know that money is being lost in operating a lunchroom does not necessarily mean that it should be discontinued. Knowing the actual loss merely gives a true value against which may be set the value of the intangible revenues from the lunchroom, such as well-fed employees, interchange of ideas among the men, and employees' good will. Any losses of the lunchroom may be charged off proportionally against such accounts as stand to benefit from these intangible benefits.

—W. A. WALTER, *Purchasing Agent, Pneumatic Scale Corporation, Ltd.*

Ex Rights

In our plant, all salaried executives have a written agreement stating that any ideas, patents, or copyrights are the property of the company, when they are of use to the company's products. This agreement further states that in the event of employees leaving the company, the company will still have a claim on patents and copyrights for a period of two years after the termination of employment. If one of our employees wishes to patent something that he feels does not tie in with the company's product, he need only submit his idea to our factory manager and obtain a release, which is gladly given.

—WILLIAM C. BETZ, *Master Mechanic, Fafnir Bearing Company.*

Early in my experience, I met the problem of taking to another concern some supposed trade secrets, being warned by the shop owner that I was not to disclose to my new employers certain methods. Later, in my new position, I soon found out the fallacy of such tactics, for the methods there were far more progressive. It pleased me to have my former superintendent pay me a visit to inspect a new layout of our production machinery and the manner of feeding the raw stock.

It seems to me that a great deal of the myth of plant systems and cherished secrets has been exploded. Today we of modern industry realize, that to make progress, we must not only give up the old-fashioned idea of secrecy but must be ready to accept the other fellow's ideas and to give him what aid we can.

Witness the free exchange of plant management ideas, factory and shop operations, and design that takes place in the trade press, and in the presentation of papers before our large associations. Largely because of this, industrial giants with their ability to give us low priced and plentiful supplies, have been built up easily and successfully.

If a business is confronted with the problem of letting a valuable man go because some other concern is more ready to pay him a more commensurate price for his services, do not embitter his feelings at parting by trying to make him feel that he is in duty bound to forget all his past accomplishments. It would be impossible to do it anyhow, for most of us automatically build our future from our past experiences.

—CHARLES A. WILLEY, *Superintendent of Manufacturing, Hoyt Electrical Instrument Works.*

Anticipation Without Realization

So far as a man himself in concerned, it is better for his own peace of mind that he should learn not to expect anything until it is actually in his hands. So far as a company or plant is concerned, it is better for its own prestige and good name that a given policy shall not be embarked upon unless there is every intention of continuing it. Where a scheme is in the nature of an experiment or where it is contingent upon the profits made by the company, the fact of its experimental or contingent nature should be made quite clear. It is not only sound ethics, it is sound policy to act unswervingly upon the principle of the square deal. What may appear perfectly justified on both counts to the employer who knows all the facts, may not so appear to the workers who are ignorant at least upon certain of the factors involved. Grave discontent may be occasioned simply by reason of misunderstanding. To retain the moral approval of the workers in an enforced and morally justifiable but unpopular decision, some explanation should be made.

—W. R. NEEDHAM, *English Electric Company, Stafford, England.*

Bonuses or any other kind of reward not definitely established by employment contract, will arouse in the average employee a feeling of appreciation when received, but only if he is otherwise content with his regular income and working conditions. On the other hand, if he receives fifty-two times a year, a pay envelope, which he is firmly convinced does not represent a fair and adequate remuneration for his efforts and services, a yearly bonus, unless very liberal indeed, could hardly remove the bad taste and would not create a permanent loyalty.

The average employee, with income just large enough to keep him going from one pay day to another, as a rule does not belong to that class which receives bonuses or other periodic extra compensation. But, whoever the recipient of a bonus may be, unless his regular income, plus any bonus he may receive, add up to a figure which he feels is a fair and adequate remuneration for his services, he would have no occasion to respond to the stimulus of extra compensation.

It all simmers down to whether or not the sum total

of his income is satisfactory. How this sum is composed matters little in the long run, so that preference for the one or the other scheme would seem a matter of individual taste or inclination rather than something to be settled by a general opinion or ruling.

—Wm. A. Rosenberger, *Assistant Chief Engineer, Pangborn Corporation.*

Is Propaganda Profitable?

Yes. Propaganda is needed to educate the public to what extent they are indebted to the mechanical trade. There are two key industries in the world. One is agriculture and the other is the mechanical industry. Everyone is familiar with the poor income of the former, but few ever stop to think that everyone in the latter, from the humble machinist to the managing director receive compensation quite out of keeping with the important nature of their work.

It has been said that every American uses motive powers and mechanical appliances equal to 100 slaves. Everyone today is dependent on the mechanical industry. There is need for propaganda for our industry, and for the proper appreciation of both the captains and privates of the mechanical trade. —Alfred Layzell.

Generally speaking, there does not seem to be any good reason for the metal-working industry to follow the lead of the public utility corporations in an endeavor to create good will. However, at the present time an unusual situation exists. Until recent years, the public at large did not question the wisdom of the increasing mechanization of industry. Of late, there has been a change in public sentiment, and it is not uncommon to find individuals who believe that the widespread use of machinery has played an important part in the present plight of unemployed citizens.

At this time, it might be well for the metal-working industry to consider carefully the advisability of intelligent advertising to combat this erroneous belief held by part of the public. Examples in the past of opposition to labor-saving devices now generally admitted to be economically sound could be mentioned. Such facts as the greater numbers now employed in the automotive industry as compared with fifteen years ago could be quoted. —H. Greenhalf,

Ford Motor Company of Canada.

How Much Incentive?

Our experience with premium systems assures us that they cannot be carried on successfully over a period of time. That you are dealing with all kinds of dispositions and characters is easily the most important problem. Some men are rapid workers, some are slow; some are cheerful, others sullen; some are pliable and subject to instruction, others are anything but open-minded to progress. The latter insist that such schemes will reduce their future work. Such beliefs will finally destroy any system that savors of piecework or continual activity on the part of individuals.

We tried such a scheme some years ago, placing a price on the work. From this the workmen's wages were deducted and the balance split fifty-fifty. The price placed on the work was fair being derived from an average obtained under actual conditions. This was agreeable to all, before it was put into effect. Soon rapid workers were doubling their pay. Others, not so fortunate, were breaking even without extra compensation. Still others were falling behind, though they still received the regular hourly rate without losing a cent.

Finally, dissatisfaction grew in the slow ranks; they charging that sufficient time was not allowed. Then, poor work began to come through from all hands, and those who were profiting handsomely began to lose the first part of each week, one, two or three days—too much prosperity. The men wrangled among themselves until several fights put the finishing touches to the whole scheme. —R. H. Dauterich,

The Crescent Engineering Company.

Salesmen in the Shop

To have the salesman continually visiting the plant, checking up on the progress of his clients' orders, wastes valuable sales time. In a plant where I was recently engaged, the problem became so acute that the following procedure was developed.

The order was made out in triplicate when received at the factory, and carried the salesman's name in the upper right-hand corner. The departmental foreman, after carefully consulting his works schedule, promised a delivery date of which the sales division was immediately advised. The factory superintendent filed his copy of the order for reference a few days in advance of the promised date. A card system, posted by the foreman's clerk, followed the daily progress of the job. The shop foreman removed his order copy where the filed data appeared and on his shop rounds made certain that the delivery date would be met. Any unavoidable delays were thus brought to his attention. When an extension of time was necessary, the sales division was notified. The salesman was thus able to relay accurate information to the customer without upsetting shop schedules.

—H. S. Deeley, *Planning Engineer, Johns-Manville Company, Ltd., Asbestos, Quebec, Canada.*

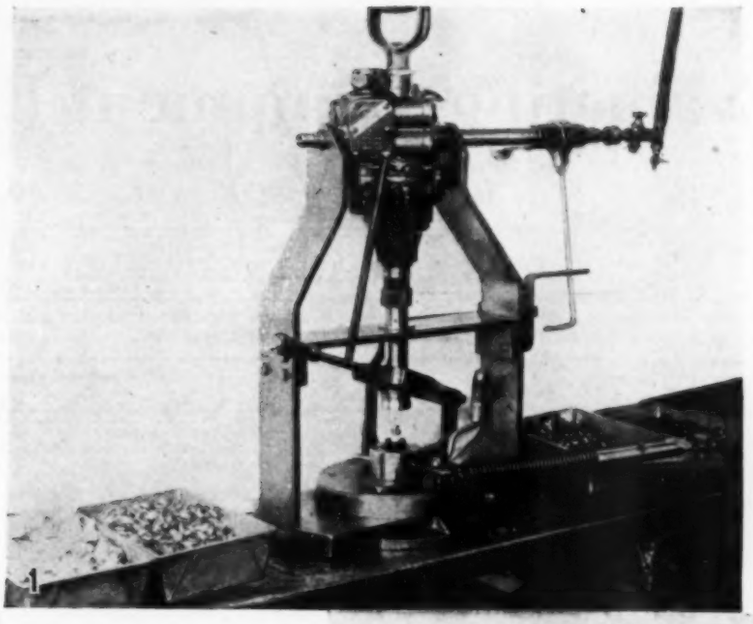
Give the salesman free access to the shop. If he cannot be trusted in the shop, it would be better to replace him than to break down his enthusiasm by barring him. The factory manager can guard against irregularities, such as aimless wandering or tipping to secure preference, by sending a clerk with the salesman. The extra cost of having a clerk with the salesman while in the shop would be more than offset by the resulting good will and co-operative spirit.

A salesman was hired to sell for a company manufacturing a special line of tools, and on going through the factory one day, he noticed an automatic standing idle. A few days later, when calling on a customer, he asked if they had any automatic work to let out. He received blue prints on some parts, and after sending them in for quotations, secured work to keep the idle automatic busy for several months.

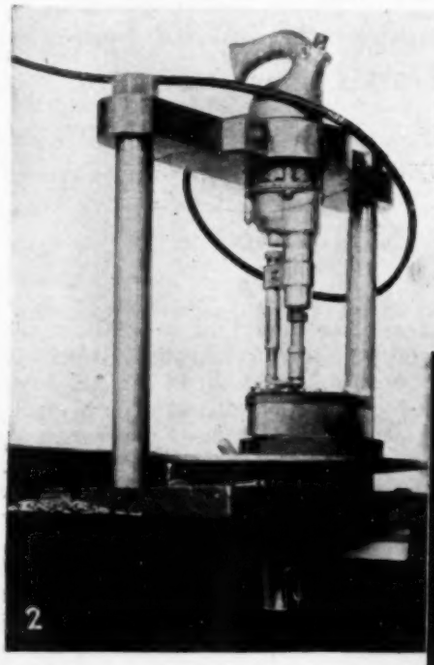
Don't open the factory door to everybody, but certainly open it to the man who is selling the service that you render. —C. F. Staples.

Portable Tools *Applied to Stationary Service*

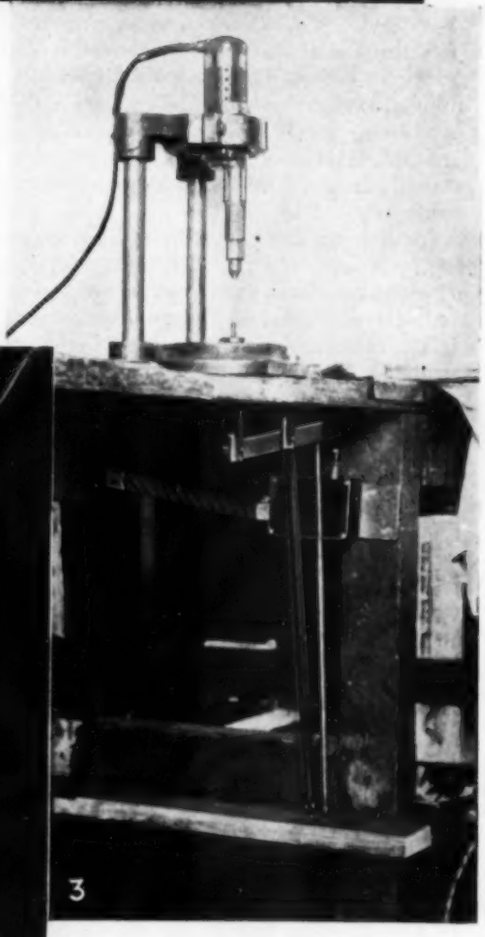
Photographs by courtesy of the Independent Pneumatic Tool Company, Chicago



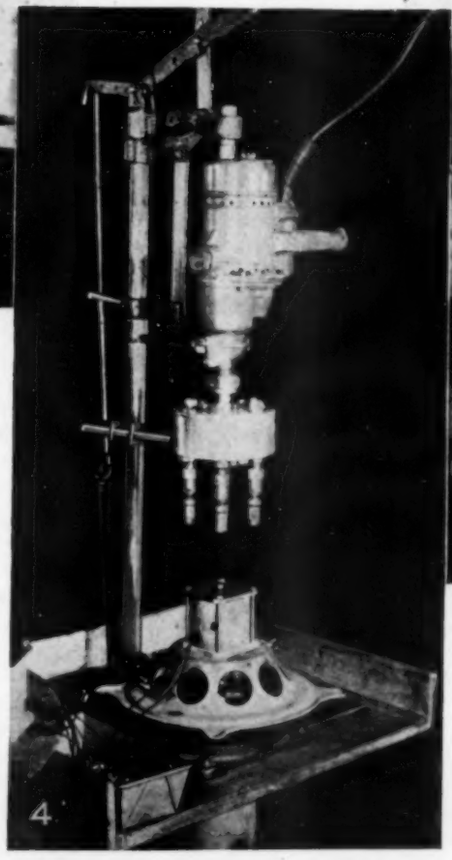
[1] This standard pneumatic tool is designed to assure minimum breakage in spark plug assembly. The chuck in which the plug body is held is free to rotate against the tension of the helical spring when the torque exceeds a fixed amount, read on the scale. Rotation of the chuck, through a system of levers, cuts off the air supply to the tool



[2] Simple arrangement for a combination electric screwdriver and nut setter. The work, an instrument panel, is supported on a rotary table and raised into the tool by a foot controlled lever. Nuts or screws are fed from the magazine at the left of the spindle

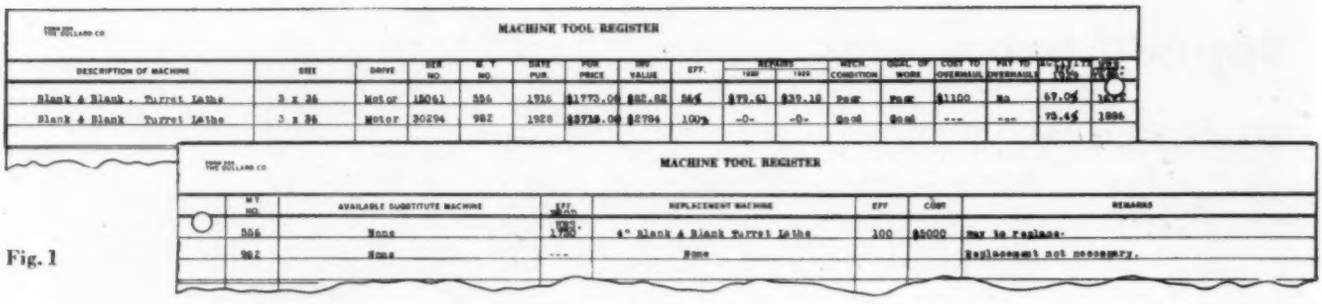


[3] Another adaptation of a portable electric screwdriver to a stationary job. The foot lever raises the work mandrel toward the tool spindle, at the same time closing the control switch by contact with an adjustable plunger



[4] When the multiple-spindle head was applied to this portable electric tool, production jumped from 600 to 2,000 units per day, and one man replaced four. Four ¼-in. bolts are driven simultaneously in the dynamic speaker head. This outfit paid for itself in 2½ months

Evaluating Equipment Efficiency



MACHINE TOOL REGISTER

DESCRIPTION OF MACHINE	SIZE	DRIVE	SER. NO.	M. T. NO.	DATE PUR.	PUR. PRICE	INV. VALUE	EFF.	REPAIRS 1930	REPAIRS 1929	MECH. CONDITION	GEN'L. OF WORK	COST TO OVERHAUL	PAY TO OVERHAUL	ACTUAL HRS. WORKED (1930)	ACTUAL HRS. WORKED (1929)
Blank & Blank, Turret Lathe	3 x 26	Motor	18061	556	1916	$1773.00	$82.82	96%	$79.61	$29.18	Poor	Poor	$1100	No	67.0%	1672
Blank & Blank Turret Lathe	3 x 26	Motor	30294	982	1928	$2738.00	$2794	100%	-0-	-0-	Good	Good	---	---	75.4%	1886

MACHINE TOOL REGISTER

M.T. NO.	AVAILABLE SUBSTITUTE MACHINE	EFF. (1930) (1929)	REPLACEMENT MACHINE	EFF	COST	REMARKS
556	None	75% 75%	4" Blank & Blank Turret Lathe	100	$5000	May be replaced.
982	None	---	None			Replacement not necessary.

Fig. 1

Plan in use by the Bullard Company affords a simple method of determining whether to retain or replace production equipment

K. H. CONDIT
Editor

PRACTICALLY every manufacturing company in the metal-working field, whose prospects are not utterly hopeless, has accepted the principle that it pays to use modern production equipment. Some of them, of course, are more active than others in applying the principle. Methods of application vary with the individual idiosyncrasies of the works manager or superintendent.

In general, those machines that are considered to be least efficient are replaced first, but the determination of relative efficiency is not always easy. One of the simplest and most easily applicable methods of arriving at an estimate of effectiveness is that in use at the Bridgeport plant of the Bullard Company.

Register Tells When to Replace

Decisions to replace equipment naturally are made by the chief executives of the organization. These decisions are based on the information contained in the machine-tool register, the left- and right-hand page headings of which are illustrated in Fig. 1. A glance at the illustration will show that most of the headings are self-explanatory. For the others, it should be said that the serial number is that of the maker, the M.T. number that of the Bullard Company.

In the first of the four columns headed "EFF." is the critical factor which decides replacement. The percentage figure entered in this column represents the combined opinion of the works manager's office, the tool design and standards department, the foreman, the inspector, and the repair department as to the effectiveness of the machine compared with the best machine on the market.

Back of these opinions lie the various records shown in Fig. 2. The repair cost record does not figure in the efficiency rating but it is considered along with it when replacement is being discussed. The important data from these records are transferred to the register. The machine tool efficiency record form is a work sheet for recording information. The same form divided in half and printed on both sides of a 5x8 card provides a permanent record for the standards department.

Obviously, the best machine on the market will be 100 per cent efficient. If the machine will turn out 90 per cent as many pieces in the same time it is 90 per cent efficient as to quantity of production. But 10 per cent of the output may fail to pass inspection for one reason or another, in which case the machine as regards quality of product is only 90 per cent efficient. Therefore the net efficiency is only 90x90 per cent, or 81 per cent.

Furthermore, if the machine is being humored to its present effectiveness by an exceptionally skillful operator, and fails to do as well in the hands of the average operator, its efficiency rating is reduced still more.

It is the intention of the Bullard management to replace all machine equipment rated at 75 per cent efficiency, or less. Those units showing the lowest ratings are considered first. Generally speaking, of course, the oldest machines show the lowest efficiencies.

Every machine rated at less than 75 per cent is tagged with a plain blue tag, Fig. 2, and the department foreman is held responsible for seeing that no work is routed to this machine when there is a more efficient machine available.

Good, Fair, or Poor

Returning now to the headings of the machine-tool register, the mechanical condition of the machine is given as good, fair, or poor, and the same remarks apply to quality of work. The last column carries the actual number of hours worked during the preceding year, and the column to the left, the percentage which this number is of 2,500 hr., the full working period.

On the right-hand page the Bullard machine number is repeated in the first column. In the second column is entered a record of any other machine in the shop to which the same work could be routed. In the next

THE BULLARD CO

MACHINE TOOL EFFICIENCY RECORD

DEPT. #30 DATE Nov. 16, 1930

DESCRIPTION OF MACHINE TOOL BLANK & BLANK Turret Lathe 3" x 36

SPECIAL ATTACHMENTS None VALUE

M. T. No. 982 SERIAL No. 30,294 MAKE Blank & Blank

DRIVE Motor ACTUAL CAPACITY 3" x 36"

DATE PURCHASED 1928 PURCHASE PRICE $3713.00 INVENTORY VALUE $2784.00 DATE 11.18.30

APPROVED STANDARD SPEED OF DRIVER

MECHANICAL CONDITION Good QUALITY AND ACCURACY OF WORK PRODUCED Good

EFFICIENCY RATING COMPARED WITH BEST KNOWN MACHINE 100%

REPAIR & MAINTENANCE RECORD

YEAR	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
COST	None	None	None							

REMARKS ON REPAIR COST

MACHINE ACTIVITY

YEAR	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
HOURS		1886	1600							
%		75.4%	64.0%							

COST OF OVERHAULING None WOULD IT PAY TO OVERHAUL ------- EFF. 100 %

BY RE-ROUTING WORK CAN THIS MACHINE BE DISPENSED WITH No

IF SO, WHAT AVAILABLE MACHINE CAN BE USED ----- EFF. %

DESCRIPTION OF REPLACEMENT MACHINE -------

EFF. %

COST OF REPLACEMENT MACHINE -------

REMARKS & RECOMMENDATIONS Replacement not necessary

FINAL DISPOSITION DATE

FORM 444

DEPT. 136
MILLING
MACH. #599
PURCHASED - 1917
EFF. - 67%
MECH. CONDITION - Fair
PAY TO OVERHAUL - No

(OVER)

REMARKS
No power cross or vertical feed

REPLACEMENTS
#2 [redacted] H.P. Miller

Fig. 2—Back of the Machine Tool Register are these cards and sheets which take the guess out of replacements

FORM 883 REV

DEPT. No. 141 **M. T. INSPECTION AND REPAIRS** DATE 10-6-30

THE BULLARD CO

M. T	REPAIRS NEEDED	DATE REPAIRED	MAN WORKING	HRS.
519	Scrape Ways and Line up Cross-Slide	10-6-30	#130	9
	Line up Spindle; check bearings	11-12-30	#1240	4

column is listed the efficient product hours, which means the estimated number of hours the replacement machine could be kept busy.

Then comes the name of the replacement machine, which would of course be 100 per cent efficient, and next its cost. It should be remembered that some old equipment may have to be kept to make repair parts for discontinued models. The amount of such equipment will depend on the policy of the company toward such repairs. In addition, consideration should be given to the consequential savings in repairs and such items. They may amount to even more than the production cost savings.

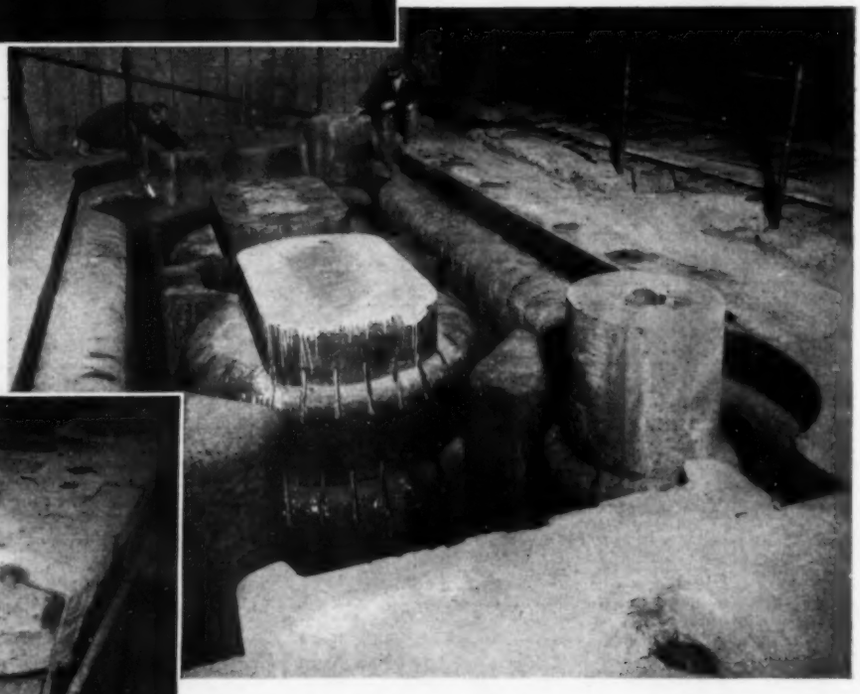
Probably every management employs some such reasoning as this when it considers the replacement problem, but this method of supplying the facts on which to base decisions transforms the maximum amount of guesswork into practical, measurable factors.

460,000 POUNDS

SIX MACHINES per casting, a direct inversion of the usual machining processes, were used in finishing a 460,000-lb. casting, to date the world's largest, at the Lehigh (Pa.) plant of the Bethlehem Steel Company. The casting is a platen, or cylinder jacket, for the 14,000-ton forging press at the Bethlehem plant, is 12 ft. 10 in. high, 23 ft. 4 in. long, and 10 ft. 2 in. wide, and took ten weeks to complete

January 13

ABOVE — Six open-hearth furnaces melted steel for simultaneous pouring through four runners. Five ladles of steel and one of cast iron were on hand during the pouring, which required ten min. Total pouring time, including filling the sinkheads, or risers, as the casting shrunk in cooling, was 38 min. Sinkheads were topped with 70 tons of iron, from the sixth ladle, later removed before the casting was taken from the mold



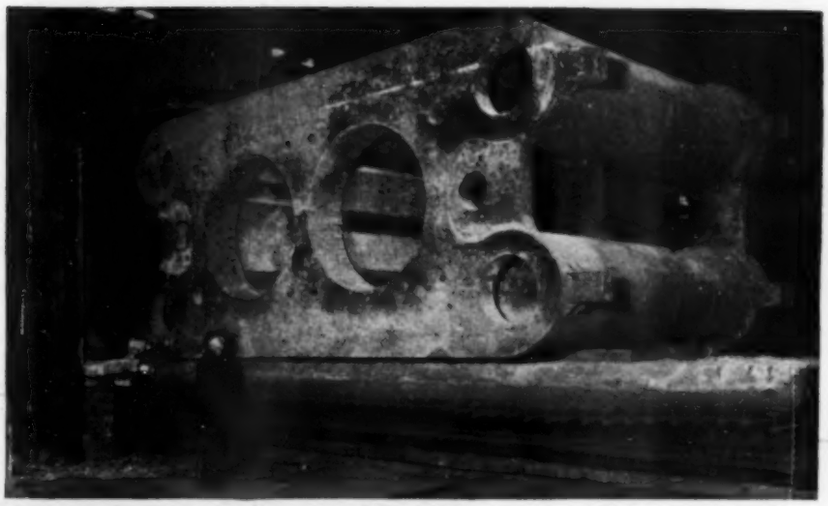
December 20

ABOVE—Patterns and coreboxes requiring 13,060 ft. of lumber and 2,000 man-hours of labor were necessary preliminaries to casting. Molding was done in a concrete pit with heavy steel reinforcing over its full surface, while adjacent pits were filled in and braced. The 60-ton cores for cylinder holes were in effect solid brick shafts made in three sections to permit handling. Two tons of nails pockmarked the mold surfaces

January 23

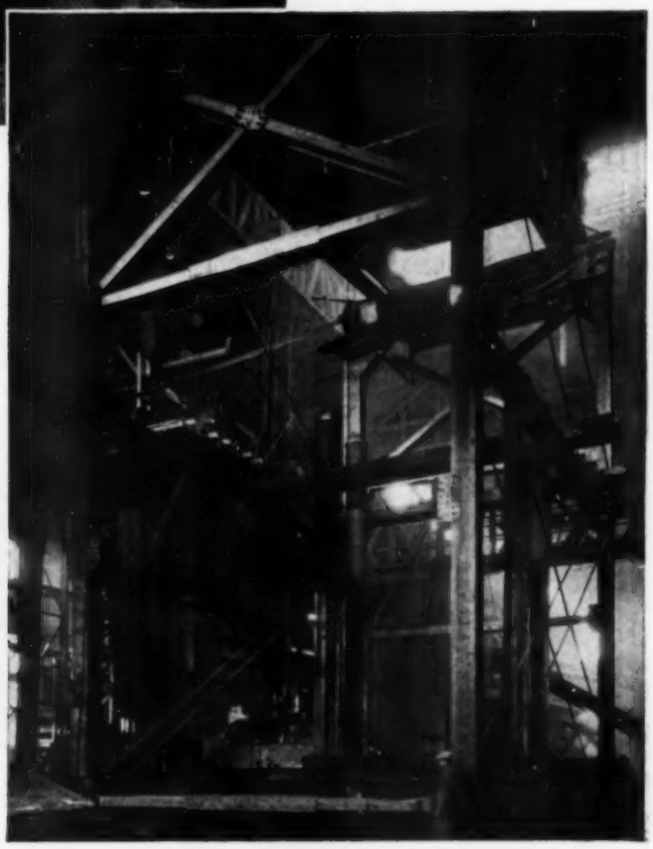
LEFT — After 10 days in the mold, the superstructure was removed and the sinkheads burned off, then the casting was lifted by two 120-ton cranes. No difficulty whatever was encountered in removing cores

January 27
RIGHT—Annealing, after four days for cleaning, was done in a large car-bottom annealing furnace. Six days were required to bring the casting up to heat

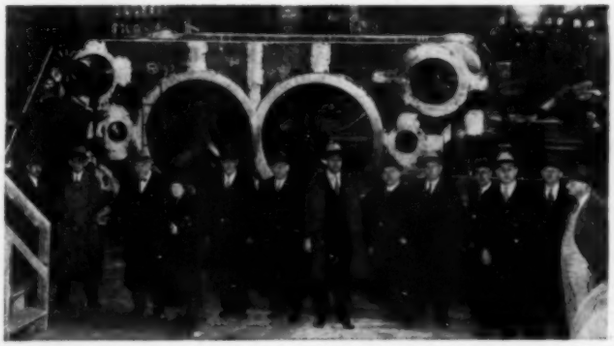


February 8
BELOW — Six machines were brought to the casting, which rested on a concrete slab, to machine it simultaneously. Two boring machines handled the cylinder holes, four were used on the four column holes

February 20
BELOW — A special crane structure, carrying four ladle hoists, has been rigged up over the forging press to place the casting. The original press, completed in 1895, had a two-part cast-iron cylinder jacket. It was found easier, after 36 years, to build a structure to raise the platen 55 ft. than to remove the corner columns



February 16
BELOW — A group of editors inspec final machining. Chester B. Lord, Associate Editor of *American Machinist*, is second from the left in the group



The Foreman's Round Table

SOMETHING FOR NOTHING?

"WHAT'S this I hear about you being the apostle of shorter hours, Ed?" questioned Al as the two foremen started homeward. "Been listening to someone again?"

"I don't listen to anybody, I do my own thinking. It's just as plain as a sand hole in a cylinder casting that if everyone is going to have work, and there is only so much work to be done, it must be divided up into smaller portions. That's logic, isn't it?"

"Yes; the usual conception of logic, where you jump at a conclusion and then attempt to justify it. But listen, Ed, do you seriously believe that you can get something for nothing?"

"I can't, but other people succeed in getting about everything I have, without giving very much in return."

"That is because you are easy, and think you are getting something which you are not. You can't get something for nothing, and you certainly can't keep on giving away something without someone paying for it."

"Meaning which, Al?"

"Meaning that shorter hours and more overhead will not add to the value of a product."

"What's that got to do with it?"

"It means raising the price of everything 25 per cent. How are you going to take care of that?"

"It won't cost 25 per cent more, because a man can do as much in six hours as he now does in eight."

"That has a familiar sound, Ed. First a man could do as much work in eight hours as he did formerly in ten. He may have done it, but not by any effort on his part. Quite the contrary, in some trades they not only reduced the daily output, but also the hourly output. They said they did that to increase the number of jobs, too, so any shortening of hours has already been anticipated. Nobody ever believed that yarn anyway, except credulous managers. You people who use that increased output fairy tale forget that you are really arguing that a man can do as much in six hours as he formerly did in ten. Can you do it in your department? Can we do it in this shop, or do you know of any contract shop where they can? Can they increase the line belt speed in the automobile shops 25 per cent?"

"Well the machines are doing it. You'll admit that, won't you?"

"Yes, in possibly one or two per cent of the total. But no matter what you or I think, you can't beat the something-for-nothing racket, and you can't beat overhead either. If we reduce the work hours we must increase the price in order to come out even, mustn't we?"

"Not necessarily. Most of our work is done by piece work and won't be affected."

"Oh, it won't, hey? Do you hear any piece workers saying they can do as much work in six hours as they used to do in ten?"

Is Ed's idea a fallacy? Is some new industry, like the automobile, the airplane, or the radio, necessary to relieve conditions?

Suggested by W. J. Owens, Foreman
Newport Rolling Mill Company

▸ ▸ ▸ Discussion of Former Topics

Whistlin' Willie

It is difficult for the worker who has spent many years in a machine shop to appreciate the possible ill effects of noise upon work. This is because he accepts, without thought, the fact that one becomes accustomed to familiar noises. While this is partially true, analysis reveals that the noises to which one may become inured, and which are therefore comparatively harmless, are continuous noises only.

A battery of machines—even noisy ones—will, in constant operation, produce a clamor which, while disturbing to a stranger, becomes almost concordant to those to whom it is a daily experience. But introduce into the clamor a foreign noise, such as is produced by an intermittently operated machine, and it will be immediately detected.

To just what an extent discordant noises affect the efficiency of a worker depends of course upon circumstances, but when corporations are willing to invest money in the reduction of noise, it appears significant. While it would be difficult and expensive to quiet the average shop to any appreciable extent, the investment for this purpose in a new plant should yield high dividends. —GILBERT G. COOMBS, *Mexican Petroleum Corporation.*

The Fortune Teller

Reaction tests are reliable to a certain extent in indicating the mentality of applicants. Their chief value will be with boys and young men. A reaction test would show their bent, their gifts, and their faults. This would enable their gifts to be utilized and their faults to be minimized. If all boys entering the metal-trades industry were subjected to some such test and put at the work which most suited their capabilities, round pegs in square holes would be practically eliminated.

With men, such good results would not be obtained, owing to the fact that they might have worked for years on work which offered little scope, so that they have grown old without any special gifts being trained. Here again a reaction test would be useful in detecting bluff or shyness in applicants and enabling their true worth to be found. It should not affect the rate paid provided a man is capable of performing his work in a satisfactory manner. —W. E. WARNER, *Herts, England.*

The End of the Road

Opportunity to advance in a company's employ is limited by a man's capabilities as well as by factors over which he has no control. A man should be able to judge whether he has not been advanced because of himself, or because of conditions. If the fault is with the company, the man should attempt to better his chance elsewhere. Some men are not fitted for a better position because of incompetence or lack of ambition. These men do not need to be advised of their inability to advance.

Generally, foremen are instrumental in a man being transferred, because the higher-ups do not know the individual's worth. A selfish foreman who holds back good men is hurting himself, as he will have to replace them sooner or later anyway, because they are usually "found" by someone else, or else they get discouraged and leave. —M. E. ROTCHY, *Celite Corporation.*

Age and Its Compensation

An employee who has a record of honest work and effort behind him is to be valued, which fact most employers recognize by trying to build up an organization of such men. All other things being equal, the old and known employee is worth more to an employer than is a new man, and is properly rewarded by extra wages or other compensation. Length of service is, however, not the only thing to judge men by. Skill, experience, general knowledge, and the quantity and quality of work produced by a man are criteria to be used in fixing his wage rate and his place in an organization.

Dividing employees into groups with equal wage rates is poor policy; it does not take into consideration the fact that employees even in a group, are not all of equal value to an employer. The wage rate set by the average favors the least efficient at the expense of the most efficient, a condition which is not conducive to individual effort. —GEORGE FIELDING, *Engineering Department, E. I. du Pont de Nemours & Company.*

The Exception to the Rule

With production systems as we find them to-day, an exceptional man earning more than the average, is found in nearly every shop. Though sometimes victimized, he should not be, for it is the system that is faulty, not the man. One who, by perseverance and intelligence, outstrips his compeers in quantity or quality should gain, not lose. When this creates undue jealousy, it is wise to suggest an appropriate weekly wage, as leading man in his own section, to help and advise other less efficient workers.

Such an offer will almost invariably be acceptable, for he knows the uncertainty of piece-work, and prefers a regular wage to haphazard, up-and-down earnings. The firm thus gets the benefit of his skill, and other workers will also be educated somewhere near his standard. Expert supervision and ripe experience are worth paying for, and if such men were utilized, our present standard of mechanics would be raised.

Price-cutting is not fair, providing the price has been properly fixed between foreman and man. There are, of course, the recognized reasons for alterations, such as new and better methods, but otherwise it upsets and

demoralizes the shop. Finally, were I an employer, I should try to invent a better method than piece-work, or standard rates, such as practised in this country. I should attach more importance to varying merit, and pay accordingly, if such a system could be arranged.

—WILLIAM BRYCE, *Sheffield, England.*

By Their Presents

The giving of presents by subordinates to their superiors is one of the worst rackets ever tolerated by industry. Aside from the fact that it is usually accomplished because no man dares say no to the solicitor who carries out the idea, it is a "give-away" on the recipient: it indicates that he is the sort of man who has, consciously or unconsciously, led the men to believe that he expects gifts. There is absolutely no legitimate excuse for the practice.

All this "personal liberty" defense that is offered in its behalf is mere subterfuge. Where the feeling that prompts it is really sincere, and of course there are exceptions to all generalities, wouldn't it be a lot finer if all the men so disposed stayed past the closing whistle personally to wish the season's greetings to the man they respect and honor. I know that, if he is worthy, he will appreciate this personal thoughtfulness far more than a present wrung from reluctant contributors.

—CHARLES KLYNE, *Foreman, Russel Machine Company.*

Who's Who in Industry

It would be interesting to know if a scheme of payment for various workers, based on the skill required, conditions of work, degree of responsibility, etc., has ever been actually applied. As a "dream" solution to the many anomalies one meets, it has appealed to me for some time. One can find many examples of a half-hearted admission of such inequalities by a slightly higher scale of pay for the more skilled job. Undoubtedly many unfair conditions of payment exist in the various grades of our industry and between different industries in both shop and office. Any efforts which can be made to "weight" the various working factors to obtain a fairer figure are to be commended.

—S. A. KNIGHT, *Tuz Khurmatu, Irak.*

Going Soft

Men are taking a more personal interest in their jobs than ever before. They have a sense of ownership of it, they are sure that if they have done good work and have been laid off, the company will send for them as soon as work opens up. The workmen have been drawing good wages and in many companies have invested their surplus in the stock of the company, receiving dividends as added income.

I am in favor of some plan being worked out whereby the workmen and the company co-operate to lay away a reserve fund to be used to employ men when demand slackens. If men were sure of continuous employment, they would not be so apt to restrict their purchases as they have done in 1930 and thus create a period of unemployment. Security of employment and income gives a man confidence, and he is willing to spend regularly. It might be possible to put half the overtime bonus away as a reserve to the workman's credit.

The usual profit-sharing plans permit the worker to share in the profits of the company, but do not ask the worker to share in the losses. He takes his losses in being out of work or on short hours or reduced pay. It is, therefore, hard for the average worker to lay up a surplus. Management will have to devise some plans whereby the worker has adequate wages to live upon and a surplus to put away for periods of slack work, sickness, or accidents. —E. H. TINGLEY, *Secretary, National Association of Foremen*

Age and Its Compensations

As the value of employees to the firm is dependent on their individual output, considering both quality and quantity, it becomes apparent that their reward, or wages, should be based on their individual worth rather than on age or seniority.

Under the seniority system, there is no incentive for individual initiative because every employee realizes that only by rounding out a definite term of service can he be entitled to an increase in wages. The natural tendency would be, therefore, to do just enough to get by the foreman.

When wages are based on skill, knowledge, and experience, however, the exceptional worker will be singled out and rewarded. This will be an incentive to other employees to improve their own work and so merit the higher wage. Also, when employees are confident that individual effort and initiative will be appreciated and rewarded, they will feel the urge to acquire a broader knowledge of their own work and its relation to all other work, with the result that the general efficiency and morale of the organization will be raised. Further, it will provide men of initiative on whom the firm can depend and, when the need arises, promote to positions of greater responsibility.

Wage scales should be founded on a fair living wage for unskilled labor in the section of the country in which the firm is located. Wages should then be graded upward according to the skill, knowledge, and experience required for the work. In each division or trade classification there should be a scale of wages within definitely set limits.

For instance, tool makers would receive a basic wage rate that is based on the knowledge, skill, and experience required for this work. Naturally this rate is higher than that received by machine hands and machinists. Then, as a toolmaker applies his skill, knowledge, and experience to the work assigned him and consistently produces work of greater accuracy and quantity than that produced by his fellow toolmakers, resulting in greater profits for the firm, he would share in this profit by having his wage rate raised above the common level.

This system would be equally fair to newcomers and to the seniority group, as an incentive for self-improvement is provided and all have an equal opportunity to advance.

From this analysis of the problem, we establish the fact that wage rates should be based on skill, knowledge, and experience rather than on age or seniority.

—JOHN A. LAWSON, *Sales Department, Heald Machine Company.*

MILLING CAMS CORRECTLY

Discussion

MATTHEW HARRIS

A machine that will mill cams with races of the same width at all points

■

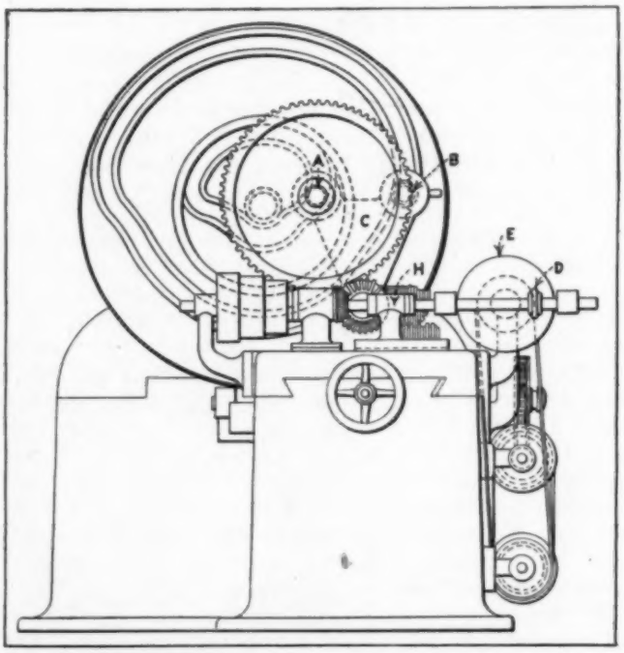


Fig. 1—Constant cutter feed is obtained by varying the face plate speed

AN INGENIOUS machine for milling the races in barrel cams in which the cam rollers mounted on swinging arms will operate without binding was described by A. L. De Leeuw in an article under the title given above, on page 503, Vol. 73, of the *American Machinist*. Upon reading the article, I was reminded of an experience in milling cams, though they were not of the same type as those described by Mr. De Leeuw.

Some years ago I was in charge of a factory that was solely engaged in the mass production of printing presses of the Gordon type. We were having trouble with the cams used for operating the platens between the feeding and the printing positions. The cams in question were face cams, and while the rollers were mounted on swinging arms, no correction was necessary on that account, as the arms swung in the same plane in which the cams revolved, and not at a right angle as was the case in Mr. De Leeuw's cams. Our trouble was that the parts of the races that were farthest from the center were narrower than at other parts. In fact the cam rollers were so tight in those parts as to necessitate filing and scraping the races. This extra operation was not only a nuisance, but it was expensive, as it took longer than it did to mill the races. Furthermore, unless the hand work was accurately done the cams made a disagreeable, whistling noise when in operation.

We could not understand how a solid cutter could make a variation in the width of the races at different points. After a thorough investigation, we finally figured it out as follows: The machine in which the cams were milled revolved them at a constant angular velocity. Thus the parts of the races that were farthest from the center traveled faster than did the parts nearer the center. This action was the same as a variable feed. Knowing that the surfaces left by all milling cutters are a series of hills and valleys, however infinitesimal, and that the faster the feed per revolution of the cutter, the higher will be the peaks of the hills, we found that the hills in the parts of the races farthest from the center were higher than in the parts nearer the center. However infinitesimal was the difference in the height, the consequence was that the parts of the cam races farthest from the center were narrower than at any other parts—and that the cam rollers would not pass through the narrowest parts.

As a result of our investigations, it was decided to design and build a machine for milling the cams, in which the following features were to be embodied:

1. The master cam was to be very much larger than the cams to be milled, so that any inaccuracies in the master cam would be minimized in the product.
2. The machine was to be enormously heavy for the work it had to do. Parts carrying the work and the cutter to be heavy enough to maintain their positions without the use of caps or gibs; caps and gibs to be used only to guide those parts in direction.
3. The work to be fed past the cutter at a uniform speed per revolution of the cutter, this feature to be accompanied either by (*a*) the cam blanks being revolved at a constant angular velocity and the revolutions of the cutter to be varied at different points in the races; or (*b*) the revolutions of the cutter to be constant and the angular velocity of the work to be varied.

The outcome was the machine illustrated in front elevation in Fig. 1, in side elevation in Fig. 2, and in

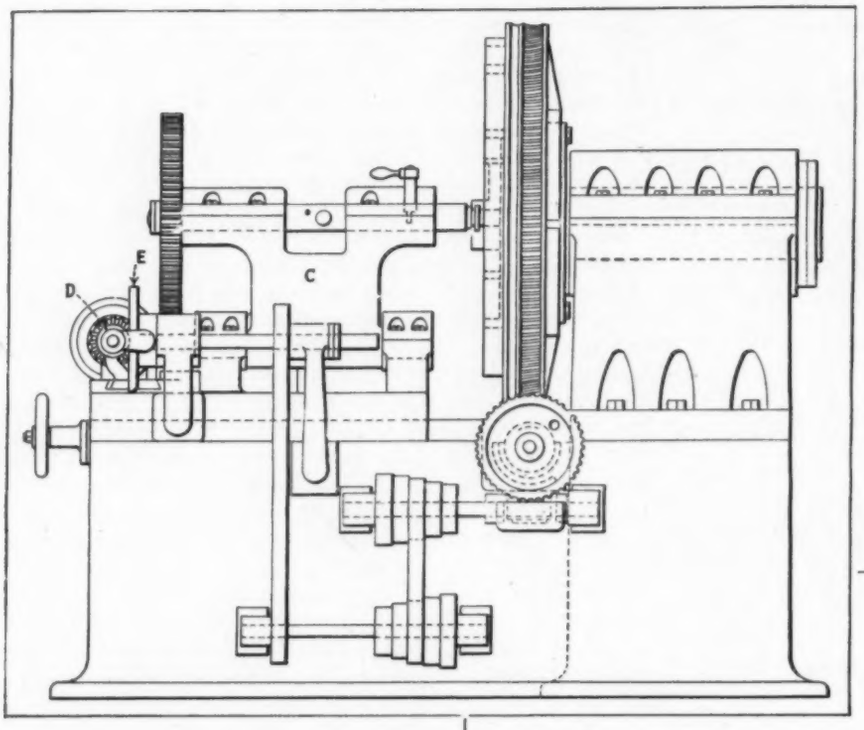
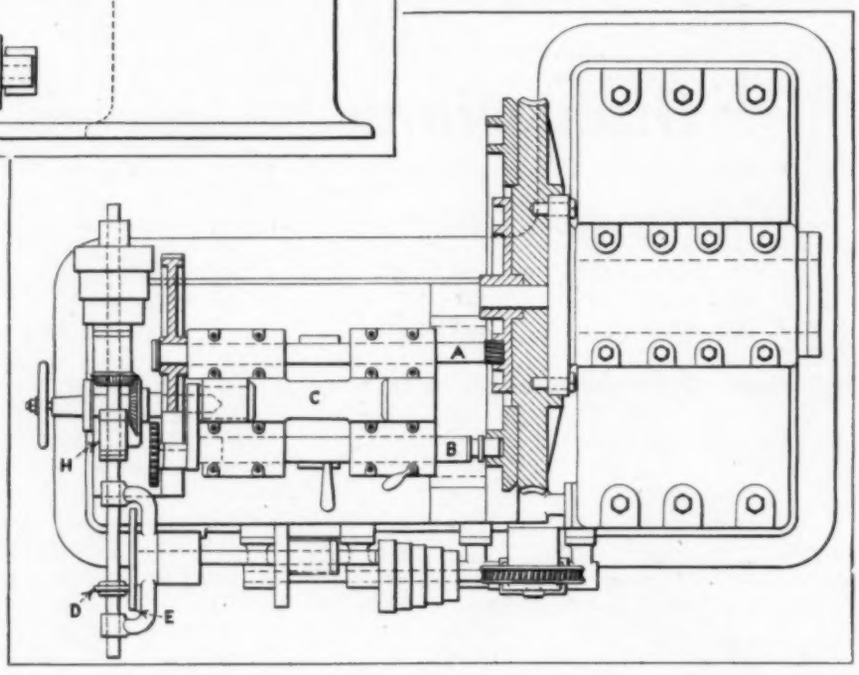


Fig. 2—When the rocker carrying the cutter spindle swings across the faceplate, friction roller *D* is moved in relation to friction disk *E*

Fig. 3—A large master cam minimizes the possibility of error



plan in Fig. 3. In all the views, like parts are denoted by the same letters. In operation, the work is mounted on the faceplate, inside the master cam, the faceplate being driven by worm gearing. The cutter spindle *A* and the blank spindle *B*, carrying the roller engaging the master cam, are mounted in the rocker *C*, which is pivoted to the carriage below. The gearing of the faceplate is driven through the friction roller *D* and the friction of disk *E*. The shaft carrying the friction roller is collared at both ends of the bearing *H*, the lower part of which bearing is fitted into a dovetailed slide in the carriage. The bearing is given sliding motion by gearing attached to the front pivot of the rocker meshing into a rack on the lower part of the bearing, so that it moves back and forth in unison with the motion of the rocker. By this means, the friction roller is moved across the face of the friction disk as the rocker is moved by the master cam. Thus the angular velocity of the faceplate and of the work mounted thereon is varied at different points of revolution.

The size of the friction disk and the amplitude of the movement of the sliding bearing were so calculated as to give a constant angular velocity of the work per revolution of the cutter at all points. Thus the hills and the valleys left by the cutter were equal in all parts of the cam races, and the races did not vary in width more than 0.00025 in. between any points. It is needless to say that the cams milled on this machine needed no hand work whatever.

Changes in the feed of the machine were provided for by cone pulleys and the belt to be seen in the side elevation. A friction clutch on the worm shaft was used to start and stop the motion of the faceplate.

A "Help Yourself" Box

H. L. WHEELER

LARGE volumes of trade and technical literature, including trade and technical journals, advertising circulars, and manufacturers' catalogs, are carefully filed by recipients. Just as large volumes, however, are destroyed or sold for waste. Of course, much of this material comes unsolicited, but often, in addition to describing a particular product, it tells how the product is made and gives a history of the industry. I have on occasion salvaged a catalog from the waste and have been pleasantly surprised to find an interesting tale of industrial progress.

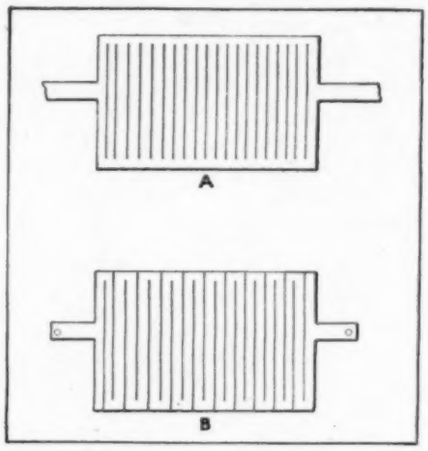
Usually when company catalog files are filled to capacity, the surplus is thrown away. One shop avoids this waste by using a novel system of disposal. All printed matter that is not filed is placed in a "Help Yourself" box located near the time clocks. Actual observation shows that all matter put in this box is taken by interested workmen and usually passed along from one man to another until worn out.

IDEAS FROM PRACTICAL MEN

Extra Heat for Molding Presses

C. B. GORDON-SALE
Shefford, England

NOT LONG AGO, the only kind of plastic molding done in the ordinary factory was with Bakelite or a similar substance, but nowadays there are literally dozens of different substances from which the engineer can choose. Sometimes it happens that a new type of product requires a special molding temperature, and the existing presses have been laid out so that the steam pressure cannot well be raised without scrapping part of a valuable plant and the installation of some new equipment. Recently, I had to deal with a case of this kind. A simple solution of the difficulty was found, which incidentally opened up fresh avenues in rapid molding especially where great skin hardness of the product was required.



The presses were supplied with wet steam at a pressure of about 120 lb. It was required to raise the temperature some 200 deg. F., but since the new process was experimental, an extra boiler was out of the question. Instead, a sheet of nickel-chrome alloy, 0.023 in. thick, and having a resistivity of approximately 90 per cm. cube, was cut in pieces of the size of the press platens. The material was cut into grids by a $\frac{1}{32}$-in. slitting saw, using plenty of lard oil as a lubricant. The pitch of the cuts was $\frac{1}{4}$ in., this pitch being determined, not by calculation of the total resistance, but by the practicability of the job. It was found necessary to make the cuts as shown at *A*, and then to complete the cuts with a hacksaw, resulting in the grids, as at *B*. An attempt to complete each cut in one operation resulted in the strips buckling badly under the cutter.

It was known that the alloy chosen would stand a current that would bring it up to a bright red heat without appreciable softening. The resistance to softening was important, since the pressure to be carried by the grids was well over one ton per sq.in. of projected area. From the total length of the grid slats, a rough calculation showed how much current would flow through them at the main's voltage. This amount of current was so excessive that a transformer had to be used. To reduce the ratio, both upper and lower heating elements were coupled in series. Actually, the ratio of transformation worked out at 2 to 1. A sheet of Micanite, 0.015 in. thick, was placed directly on the platen. Next came the grid, then another sheet of Micanite, and finally, a copper binding plate 0.10 in. thick, which served as a clamp. This material, because of its high thermal conductivity, caused very little heat lag. Both the top and bottom platens were treated in a similar manner. It should be mentioned that the platens were still steam heated, to obtain the bulk of the heat, the grids giving the extra rise in temperature necessary for the particular molding substance in question.

In operation, it was found advisable to close the jaws of the press while under steam heat only, and then, just as full compression began, to turn on the current for ten seconds, and then to cut it off, the result was an excellent molding. Further experiments resulted in the production of an automatic press, in which the current was controlled by a dash-pot switch that could be set so as to give any particular "shot" of heat at any particular time during the pressing. This method proved to be a great advantage and enabled the output to be increased.

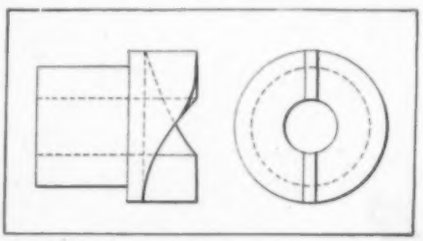
It was also found that this method might be used to advantage in molding Bakelite. In the ordinary course of events, the operation of the molds is so rapid that the parts turned out are not fully cured, and thus sometimes lack that superficial hardness which is so essential for certain service conditions. Heating elements were added to the presses, together with automatic switches, and the components turned out were found to be more fully cured than if left for considerable time under the normal temperature of 140 deg. Centigrade.

In conclusion, it should be pointed out that it is not so much the temperature that is controlled as it is the quantity of electricity let loose at each "shot." The actual temperature of the heating element during the passage of the current is probably much higher than is advisable for pressing. But since the heat capacity of the nickel-chrome grid is small, this does not matter, but actually proves to be an advantage.

An Improvised Method of Making Helical Cams

GEORGE WILSON

We are using a number of cylinder hones on production work. The stones of the hones are brought outward by means of band brakes, stationary on the machine columns. To operate the expansive mechanism, the ends of the bands are drawn together by means of helical cams. One of the cams is attached to a hand lever, so that by moving the lever the cam is partially revolved.



Since the original cams that were on the machines were made of soft brass, and soon wore out, we decided to renew the worn parts by replacing them with parts made of steel.

The cam lugs were faced off, removing the worn cam lobes, and holes were drilled in the lugs to receive the necks of the new cams, one of which is shown in the sketch. Because our facilities for making the cams were limited, the following rough-and-ready methods were used to produce the helical surfaces: Pieces of steel were chucked, turned, and bored in the lathe; hacksaw cuts were made across the ends to a depth equal to the lead of the cams. The angle of helix for each lobe was laid off by using a piece of shim stock as a flexible ruler, the edge being placed flush with the top of the saw cut on one side, and leading around to the bottom of the cut on the other side.

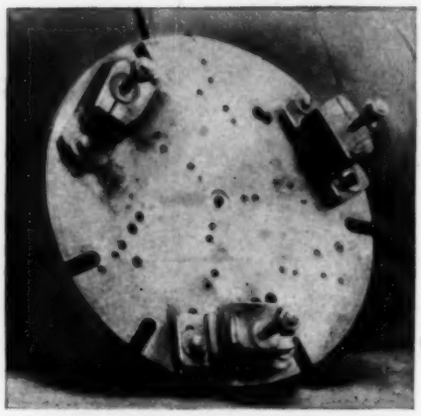
After the helix lines had been scribed, the surplus stock was chipped and filed nearly to the lines. The pieces were then rechucked in the lathe, and the remaining stock was nibbled off close to the lines by reciprocating the toolblock in which a suitable tool was held in the toolpost. The chuck was slightly rotated by hand at the end of each cut, and the carriage was slowly "hitched" along to keep the tool close to the line. The surfaces produced by this nibbling process were afterward filed to the lines, which made them good enough for the job. To check the accuracy of the contours, two cams were strung on a rod, face to face. After the cams were finished, they were sweated into the lugs, using soft solder.

■

Holding Flywheels Without Distortion

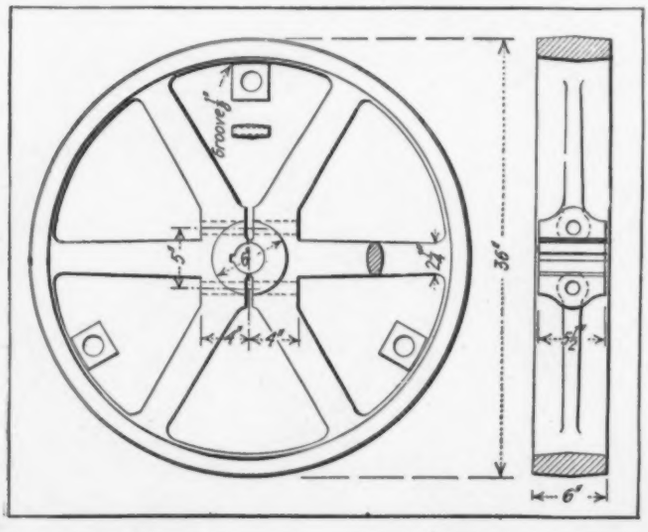
CHARLES C. TOMNEY
Tool Designer and Time-Study Engineer, Brunswick-Kroeschell Company

We have to machine a quantity of comparatively small flywheels of several sizes of the type illustrated in Fig. 1. While there is nothing new in the process of machining, the method of holding the wheels has some rather novel features. Instead of holding them in a chuck they are held on studs by lugs in a special fixture. The lugs are spaced 120 deg. apart, giving a three-point bearing. Since $1\frac{1}{8}$-in. holes are cored in the lugs, and the studs are 1 in. in diameter, there is plenty of allowance for shifting the wheels for truing them on the boring mill without moving the fixture.



By a study of Fig. 1 it will be seen that instead of being flat, the lugs are rounded on the front and rear surfaces, and that they are grooved close to the rims of the wheels. Rounding the lugs permits them to bear in the center, should they be twisted or otherwise distorted. Since the lugs are broken off after the wheels have been machined, the grooves, or nicks, permit them to be broken close to the rims. The remaining parts are dressed off in a few minutes, any little roughness being taken care of in the filling and painting.

The fixture for holding the wheels is shown in Fig. 2. The lugs rest on the three blocks. Holes are drilled and tapped in the fixture for locating the blocks for wheels of different sizes. A tapped hole in the center of the fixture is for the insertion of an eyebolt for the crane hook. The fixture is piloted on the boring-mill table and is provided with slots that match the T-slots in the table. Since the hubs are finished on one end only, the machining can be completed at one setting.



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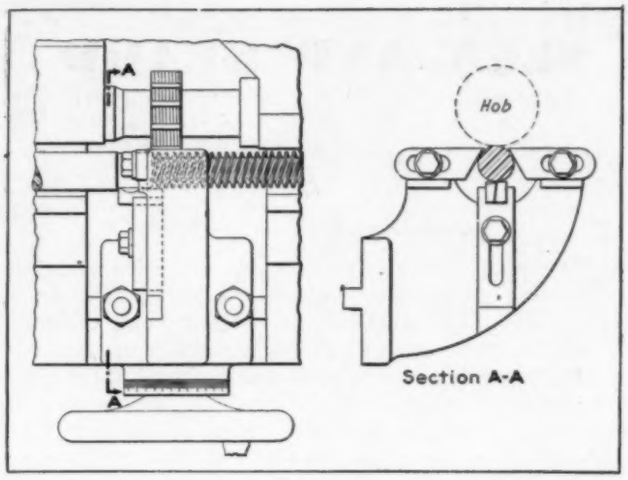
Combined Turning and Threading Operation

D. L. MEYERS

Obvious production economies are often overlooked until necessity demands a change of method. We recently had to make a quantity of worm rod of 1.167 in. diameter, double thread, 12 normal diametral pitch, which was to be finished in lengths of seven feet. It was, of course, impossible to secure commercial stock of this diameter, and as the quantity wanted did not warrant a special rolling, it was necessary to use stock of the next larger commercial diameter and to turn it to the size wanted.

Previous experience had shown us that it was both difficult and expensive to perform the turning operation on any of the available equipment, consequently, it was decided to attempt a combined turning and threading operation. It was advisable, both from a standpoint of accuracy and economy, to use the hobbing method. The hob had a leading edge and was fed at the rate of 0.010 in. per revolution of the work, axial feed. The job was handled on a gear hobber and thread miller, holding the work in a collet chuck in the spindle. The free end was supported by the tailstock center, and a follow rest was used opposite the hob.

The standard center-rest finger in the follow rest was replaced by a combined turning tool and finger, as shown in the illustration. This combination was made by mill-



ing a slot across the end of an extra-heavy steel finger, fitting it with a Stellite bit and welding them together. The Stellite portion of the resulting tool was then ground so as to have a forward cutting edge and a rear bearing heel. It was located on the follow rest to give the correct diameter to the work, and then locked in position. As illustrated, the heel acted as a rest upon the surface that had been turned by the cutting edge of the tool, therefore, the heel and the point were ground on a line parallel with the axis of the work.

The entire cost of turning was saved by using this method, as the combined turning and hobbing operation was performed in the time required for the hobbing alone. The finish obtained was excellent, as the axial movement of the turning tool was but 0.010 in. per revolution of the work. Since the machine was not long enough to do the work at one setting, after the rod had been machined for one-half of its length, it was taken out of the collet and turned end for end. There was no attempt to match the threads where they met in the center, as the rods were to be cut up into short worm-lengths, so there was very little waste.

It will be noted that while the combination of turning and hobbing can be successfully carried out on many jobs, it does not adapt itself to milling the thread. In the case of milling the thread with a single cutter, the work must rotate at a comparatively slow speed and the feed must be equivalent to the lead of the thread, which would result in a carriage feed too fast for turning.

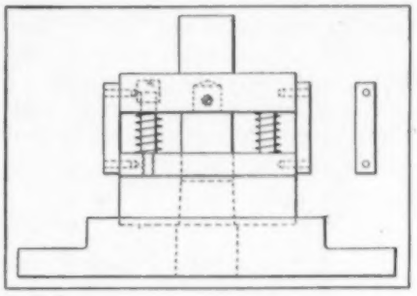
■

Stripper Holders

EDWARD HELLER

Where holes are to be pierced in the middle of large sheets, the tools are generally built without guide pins, but with spring strippers. The setting up of such tools is rather an awkward operation, because the stripper is held below the punch by its springs, preventing the punch from being entered in the die. A simple method of holding up the stripper is shown in the illustration. Two pieces of the correct length have holes drilled near their ends into which pins are driven. Mating holes, a slip fit for the pins, are drilled in the ends of the punch-holder and the stripper. The pins in the pieces are at such center distances as to permit them to be entered in the holes in the punch-holder and the stripper only when the stripper is raised so that its bottom clears the end of the punch enough to permit its entrance into the die.

When the tools are first set in the press, the stripper is held up by a clamp and the pieces having the pins are slipped into place. When the clamp is removed, the stripper is held up so that the punch can be entered into the die. When the set-up is complete, the ram of the press is lowered by hand until the punch enters the die and the stripper contacts with the die-blocks. In this position, the pieces can be removed, allowing the springs to force the stripper downward as the ram is raised.



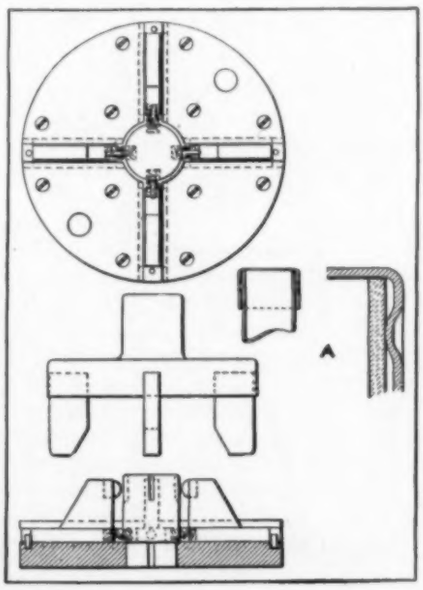
When the tools are to be removed from the press, the ram is lowered by hand as before and the pieces are attached by their pins. The ram can then be raised and the stripper will be held above the end of the punch. The tools are thus ready for the next set-up without the use of the clamp.

■

Shearing Tools for Friction Caps

S. A. MCDONALD

We had to make a large quantity of friction caps for glass containers, such as the one shown at *A*, an enlarged partial section being shown at the right. The containers were glass tubes closed at one end, and as the contents were in granular form and not deliquescent, the caps did not have to be air-tight. They were held in position on the containers by the friction of four tongues. The caps were blanked and drawn by ordinary press tools, not shown here, but the tools for shearing and forming the friction tongues are illustrated.



The lower member of the tools consists of a bolster in which are located the die; the four shearing punches attached to sliding holders; a cover plate; and four springs to keep the punch-holders away from the die. The upper member of the tools is carried in the ram of the press, and consists of four wedges.

the inclined surfaces of which match those on the backs of the punch-holders.

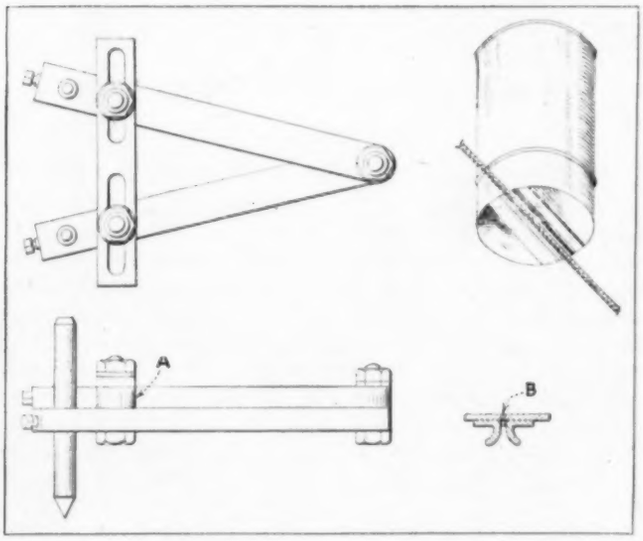
In operation, a cap is picked up by a magnetized holder and is placed upon the die in the center, thus making it unnecessary for the operator to place his hands in a dangerous position. As the ram descends, the four punch-holders are moved inwardly by the wedges in the ram, so that the punches both shear and form the four friction tongues in the caps as they enter the slots in the die. As the ram ascends, the punch-holders are forced outwardly by the springs. The slots in the die are straight and extend through the top, so as to offer no interference to the inward bends of the tongues in lifting off the caps.

■

A Spacing Center Punch and an Ingenious Line Chalker

FRANK X. SOMMERS

In going through a combined machine and sheet-metal shop the other day, I saw two devices that were new to me. The first was a spacing center punch, and the second was a device for chalking a chalk line, both of which are shown in the illustration. A number of holes were to be punched in long sheets. Since the holes were



for perforations only, they were laid out on a line made by a chalk line in the usual way, accuracy not being essential.

The spacing center punch is made to stand up and keep its correct spacing on heavy work. The holders are cheaply made of ordinary cold-rolled steel, and the center punches can easily be removed for grinding and adjusting. The spacing washer *A* is used between the clamping strap and the lower arm to keep the arms in alignment.

As the biggest job in using a chalk line is keeping it chalked, a tin can was rigged up, as shown in the sketch, to chalk the line quickly. The can is filled with talcum powder or whiting. Guides for the line are soldered to the bottom, between which a series of holes are drilled, as at *B*. Running the can over the line once or twice makes a very quick job of chalking it.

SEEN AND HEARD

●

Vulcanizing Rubber to Metal

NOW that rubber is coming into extensive use as a means of insulating one part of a machine from the vibration of another part, it is often found desirable to vulcanize the rubber to the metal employed. According to a prominent specialist in electroplating, it has been found difficult to secure a good bond between steel and rubber unless the steel surface is brass plated.

Rubber, it appears, adheres much more firmly to brass than to steel, but even when the steel is brass plated first, the rubber may pull off, taking some of the brass with it, unless special care is taken to have the metal surface chemically clean and free from oxide scale or inclusions. —*N.*

Welded Fixtures in 1914

IT'S A BIT FUNNY to think how long it takes some good ideas to percolate into enough minds to get them adopted in regular practice. Gas and arc welding have at last come to be used rather widely in making jigs and fixtures and are great savers of time and money. But it isn't as new as many seem to think. The first examples I saw were in a small bicycle factory just outside of Birmingham, England, in the early spring of 1914, nearly 17 years ago. They had a lot of fixtures welded up from flat plates using the gas flame. The arc was not then as common as it now is. I've never quite understood why the method was so slow coming into use. These fixtures were mentioned in the *American Machinist* about the same time. —*J.R.G.*

Robots

SOME OF US have stood with our mouths open watching an automatic die-sinker do its stuff apparently by magic. And now this same controlling device has been hooked up to a Monarch lathe. It doesn't help any on a straight cut so far as I can see, but when it comes to forming, necking, or machining something like a camshaft, that is another story. I saw some machine-steel spheres turned on the lathe, and they looked good both as to finish and contour.

The whole process is simple. A templet of the desired shape is filed up and attached to what used to be the taper attachment guide on the back of the lathe. A finger follows this and controls one motor on the longitudinal feed and one on the cross feed.

After all, this combination is only a descendant of the old-time copy lathe that the gun factory used for turning up gun stocks, but they didn't have electric controls in those days. Later we had pantographic machines that would make a dozen copies from an original, and a dozen impressions at once in copper print rolls for dress fabrics. —*H.*

Heat-Treatment of Aircraft Parts

TABLE I.—TYPICAL STRENGTH-WEIGHT FACTORS OF AIRCRAFT MATERIALS.

Material	Strength, lb. per sq. in.	Specific Gravity	Strength-Weight Factor*
Wrought Metals (Tension):			
Music wire, 0.01-in. in diameter	400 000	7.85	51
Alloy Steel (Heat Treated, High)	200 000	7.85	25
Alloy Steel (Heat Treated, Medium)	150 000	7.85	19
Duralumin	55 000	2.85	19
Magnesium Alloy	24 000	1.75	13
Alloy Steel (Normalized)	95 000	7.85	12.1
Mild Steel (Normalized)	55 000	7.85	7.0
Aluminum (Annealed)	12 000	2.7	4.4
Wood (Compression):			
Balsa	2 200	0.12	18
Douglas Fir	6 000	0.54	11
Spruce	4 300	0.43	10
Oak, White	5 900	0.74	8

* Obtained by dividing ultimate strength in thousands of pounds per square inch, by specific gravity.

$$\text{Strength-Weight Factor} = \frac{\text{Strength in pounds per square inch}}{\text{Specific Gravity}} \times 1000$$

TABLE II.—TEMPERING TEMPERATURES, WITH CORRESPONDING PHYSICAL PROPERTIES.

(From U. S. Army Spec. Reference (ii))

Steel	Normalizing Temperature, deg. Fahr.	Annealing Temperature, deg. Fahr.	Hardening (Quenching) Temperature, deg. Fahr.	Quenching Medium	Tempering (or Drawing) Temperature, deg. Fahr.	Tensile Strength, lb. per sq. in.	Yield Point, lb. per sq. in.	Elongation in 2 in., per cent	Reduction of Area, per cent	Brinell Hardness
S.A.E. No. 1035	.....	1525 – 1575	1525 – 1575	Water	1000	100 000	70 000	25.0	63.0	200
					1100	100 000	65 000	20.0	66.0	195
					1200	95 000	60 000	32.0	68.0	180
S.A.E. No. 1045	.....	1475 – 1525	1475 – 1525	Water	1000	115 000	80 000	20.0	55.0	230
					1100	110 000	75 000	23.0	58.00	215
					1200	100 000	70 000	25.0	60.00	200
S.A.E. No. 1095	.....	1400 – 1450	1400 – 1450	Water	650	.....	.....	.....	.....	...
S.A.E. No. 2330	1550 – 1600[a]	1250 – 1300	1475 – 1525	Oil	600	220 000	130 000	11.0	40.0	460
					800	160 000	150 000	12.0	50.0	390
					1000	125 000	100 000	15.0	55.0	270
					1200	95 000	75 000	20.0	60.0	225
S.A.E. No. 3250	1500 – 1600[a]	1225 – 1275	1425 – 1475	Oil	400	200 000	150 000	8.0	28.0	540
					600	240 000	175 000	10.0	42.0	510
					800	220 000	190 000	12.0	46.0	440
					1000	175 000	150 000	14.0	50.0	350
					1200	130 000	105 000	18.0	57.0	290
S.A.E. No. 4130X	1600 – 1700[a]	1250 – 1300	1600 – 1650	Water	400	230 000	110 000	5.0	....	...
					600	205 000	125 000	6.0	....	...
					800	190 000	160 000	8.0	....	...
					1000	145 000	115 000	12.0	....	...
					1200	115 000	90 000	20.0	....	...
S.A.E. No. 6130	1600 – 1700[a]	1250 – 1350	1600 – 1650	Oil	400	220 000	110 000	2 – 10	....	•
					600	200 000	125 000	2 – 10	....	...
					800	175 000	150 000	3 – 11	....	...
					1000	135 000	110 000	4 – 12	....	...
					1200	115 000	90 000	5 – 15	....	...
S.A.E. No. 6135	1600 – 1700[a]	1250 – 1350	1575 – 1625	Oil	400	250 000	130 000	12.5	43.0	490
					600	220 000	175 000	12.5	45.0	420
					800	200 000	175 000	12.0	48.0	400
					1000	150 000	115 000	15.0	50.0	350
					1200	120 000	95 000	20.0	53.0	240
S.A.E. No. 6195	1650 – 1750[b]	1250 – 1350	1425 – 1475	Oil	350	.....	.....	.....	.....	...

* Cooled in still air.
† Cooled in furnace.
• No data given.

TABLE III.—HEAT TREATMENT TEMPERATURES WITH CORRESPONDING PHYSICAL PROPERTIES.

(From Naval Aircraft Factory Heat Treatment Specifications)

Steel	Quenching Temperature, deg. Fahr.	Quenching Medium	Tempering Temperature, deg. Fahr.	Tensile Strength, lb. per sq. in.	Yield Point, lb. per sq. in.	Brinell Hardness: After Quenching	Brinell Hardness: After Tempering	Rockwell Hardness, "C" Scale
S.A.E. No. 1025	1615 – 1635	Air (Free)	None	55 000				
S.A.E. No. 1035	1530 – 1570	Oil	950 – 975	80 000				
S.A.E. No. 1095	1425 – 1450	Oil	500 – 610			425 – 475	250 – 300	
			800	125 000	.....	475 – 525		.....
S.A.E. No. 2330	1460 – 1480	Oil	900			525 – 575		
			1000					
			1075	105 000		258 – 296		27 – 32
			925	125 000		296 – 340		32 – 37
S.A.E. No. 4130X	1575 – 1600	Oil	775	140 000		340 – 393		37 – 43
			600	150 000		393 – 456		43 – 48
			800			200 – 250		
S.A.E. No. 6130	1600 – 1625	Oil	850	150 000	.....	250 – 300	300 – 350	.....
			900			400 – 475		

HEAT-TREATED METALS for aircraft and aircraft engine construction may be compared on a basis of their strength-weight factors, as indicated in Table I. Problems in heat-treating are greatly simplified by standardizing upon the minimum number of metals which will serve the diverse requirements. Variations of composition within a specified chemical tolerance of standard S.A.E. steels, as well as variations in thickness, may cause pronounced differences in hardness, which must be overcome by varying heat-treating temperatures. For this reason, the accompanying tables serve only as guides. Of interest in this connection are the differences in Army and Navy practice for the same materials, an indication of the varied practices now in use in various plants.

Quenching temperatures for aircraft parts are preferably held within a tolerance of plus or minus 10 or 15 deg. Recommended heat-treating temperatures are given in Tables II and III. The author recommends, for chrome-molybdenum steel No. 4130X, instead of those indicated, normalizing temperatures of 1575-1625 deg. F. with cooling in air; annealing at 1275-1325 with cooling in air or 1375-1425 with cooling in a furnace; and quenching temperatures of 1575-1625 with quenching in oil. Tempering at 680 deg. F. gives a tensile strength of 200,000, a yield point of 180,000, and an elongation in 2 in. of 5 to 7 per cent. For a tempering temperature of 775, the values are 175,000; 160,000; 7 to 9. Those for 940 deg. are 150,000; 135,000; 9 to 11. Those for 1100 deg. are 125,000; 110,000; and 11 to 15.

Abstracted from an A.S.T.M. paper by Horace T. Knerr, Consulting Metallurgical Engineer

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The Engineer's Status

A QUESTIONNAIRE designed to ascertain the economic status of the engineer has been mailed by the American Society of Mechanical Engineers to all its members. It is concise, easy to fill, and requires no signature, factors which may make it more acceptable to practising engineers and production executives than certain similar questionnaires already issued by other fact seekers. With all their failings, these questionnaires, have assisted, nevertheless, in the drawing of wage, occupation, age, and similar curves, but they have done little to improve the engineer's economic status.

It is admitted that one knows too little of the engineer's exact place and value in the scheme of things, that engineers need this knowledge, that young men planning to enter engineering need it, that engineering schools need it to adapt their curriculums to industry's changing needs. If this questionnaire can even help to fulfill these needs, it will have accomplished a great deal. If it, assisted by similar ones circulated by other engineering societies, can raise the economic status of engineers and production executives as a class, its beneficiaries will rise and call it blessed.

The Deplorable Tale of Chip Long

IN THE reign of the emperor Lung Tin there lived in the Middle Kingdom a worker in metals whom men called Chip Long. His father had bestowed his own great workroom and many tools upon him, and there were many who purchased the pieces Chip Long wrought as they had those of his father before him. Yet did Chip Long allow the thrice-beautiful workroom to fall into disrepair and the tools to become aged and worn, ever explaining that "they were good enough for the honorable father of Chip Long, so good enough for Chip Long as well."

There came finally a time when none could be found to buy his wares. "No," said they, "We can buy better wares from others, and for fewer *cash.*" Then did Chip Long moan and cry before the honorable statues of his thrice-honorable ancestors. But it availed him nothing. Buying even less than his former frugal few grains of rice each day, he departed after a little time to meet his fathers.

Then said men, "What are we to do with this thrice-ugly workroom of the departed?" And taking counsel among themselves they decided to break it up and burn it, for the tools were worthless and the workroom but rotting wood. Going within, they began to break up Chip Long's workbench to make a flame, when out rolled bag after bag labelled in Chip Long's hand with the mystic word "Reserves."

Poor Chip Long indeed! The bags held good yellow gold, gold enough to make green the eyes of the Middle Kingdom's richest, gold enough to buy not only rice, but new tools and material comforts for a dozen Chip Longs. Then said a venerable one, in the words of the Great Teacher, "Chip Long spent too little and saved too much; what Chip Long saved avails him nothing now!" And the Lords of the Upper Air looked on and snickered.

Assembly Needs Careful Men

NO ONE who studies the operations of the assembly line in an automobile plant can fail to be impressed with the care required if the completed car is to function satisfactorily to the owner. The proper tightening of nuts on connecting rods and on main bearings and the wiring of these nuts against loosening are vital to the quiet operation and long life of the engine. Rigid final inspection is out of the question. The final quality of the product depends on the reliability of the operator, for the most carefully made parts can be so assembled as to produce a most unsatisfactory product.

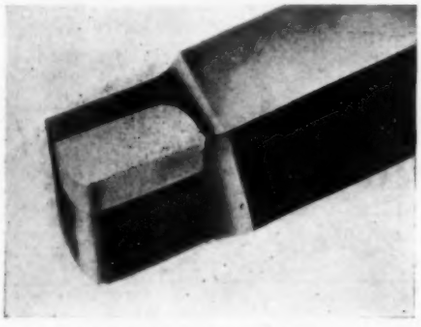
In some plants, at least, the importance of having thoroughly reliable men on the assembly line is not fully appreciated. The idea in such plants seems to be that anyone at any wage can put the parts together if they are made right. Experience, however, does not bear out any such assumption.

SHOP EQUIPMENT NEWS

"Ramet" Cutting Alloy

A NON-FERROUS cutting alloy called "Ramet," which has great strength and great hardness, has been announced by the Fansteel Products Company, Inc., North Chicago, Ill. It consists of tantalum carbide held in nickel. Like tungsten carbide the alloy is intended to be brazed upon a steel shank in the form of a tip.

Three characteristics of tantalum carbide make it particularly suitable as a cutting tool or for wire drawing dies: chemical inertness, low thermal conductivity, and a high melting point of 4,400 deg. C. The first characteristic implies that Ramet is not easily "wet" by other metals; in other words, when in contact with other metals under pressure, no smearing action occurs. More specifically, the chip does not tend to erode the cutting alloy by combining with it chemically.



Lathe bit tipped with "Ramet" tantalum-carbide cutting alloy

Because of the low thermal conductivity of Ramet, the heat developed by the cutting action remains in the chip. On test, a tip of this material has never become hot enough to melt the braze metal, even when that was zinc. For this reason, it is feasible to design the tools with relatively small rake and clearance, making possible the construction of general-purpose tools without it being necessary to construct special tools for individual applications. Low thermal conductivity also implies that Ramet expands but very little, assuring accuracy on operations with non-adjustable tools, such as reamers.

Its high melting point precludes Ramet being a cast material. In fact tantalum carbide has not yet been melted. Granules of the compound are reduced to a fine powder in a ball mill. Additions of nickel are made until the correct proportion has been reached. The powder is then pressed hydraulically into shape and the slug sintered in an inert atmosphere. This method results in a product having fine grain and freedom from porosity. Its hardness ranges from 88.5 to 90.5 on the Rockwell no-load C scale, sometimes known as the "A" scale. Bits have been made as hard as 92, but such an alloy is impractical since no abrasive wheel can grind it. The hardest varieties are selected for wire-drawing dies. These are finished by lapping with diamond dust. The ultimate strength of the average specimen ranges between 250,000 and 300,000 lb. per sq.in. Tests for both hardness and strength are made on a blank from each lot of the material.

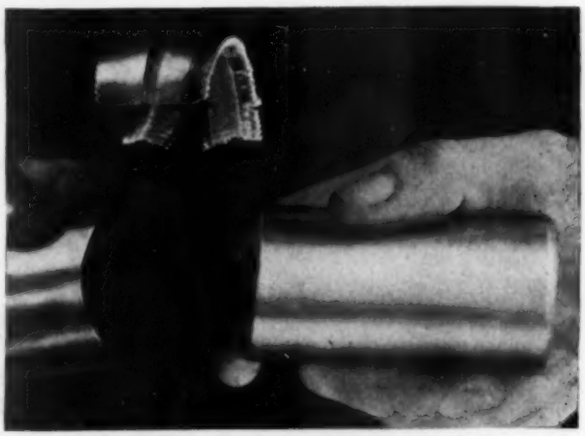
Owing to its non-wetting property, Ramet is difficult to braze without first nickel-plating it, then heat-treating it in a controlled atmosphere. Pure copper, Tobin bronze, or any of the common brazing metals may be used. The bit should have a close fit in the steel shank to make capillary action most effective. Under these conditions it is necessary only to tie a piece of copper on top of the bit and melt it in place in a hydrogen atmosphere.

Intermittent facing cut taken on a semi-steel casting with a Ramet-tipped tool. The depth of cut is $\frac{1}{2}$ in.

In using the material, the most satisfactory arrangement seems to be to maintain the feed and increase the speed of operation. On some work it has been found possible to increase both the feed and the speed.

In a demonstration, a Ramet tool cut a 15-per cent manganese-steel casting, caked with mold sand, at 130 ft. per min., using 0.005 in. feed per rev. and $\frac{1}{8}$ in. depth of cut. The chip came off at red heat, and the work was left with a smooth finish. Repeated operations on the piece resulted in no perceptible wear on the tip.

In another test made by a prom-



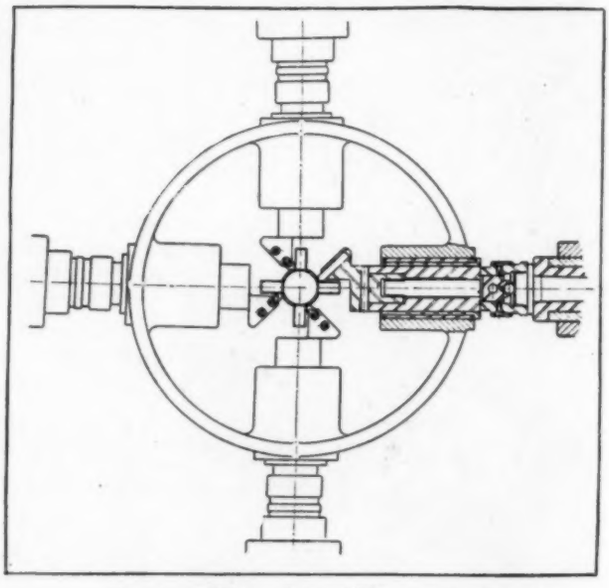
S.A.E. 1050 roller reduced from 3 to 2 in. in one cut with a Ramet tool, followed by a burnishing roller. Speed 170 ft. per min.; feed 0.02 in.

inent machine tool builder, a 3-in. bar or S.A.E. 1050 steel was cut within 0.0001 in. of size, at a speed of 170 ft. per min. with ½ in. cut and 0.02 in. feed, followed by a burnishing roller.

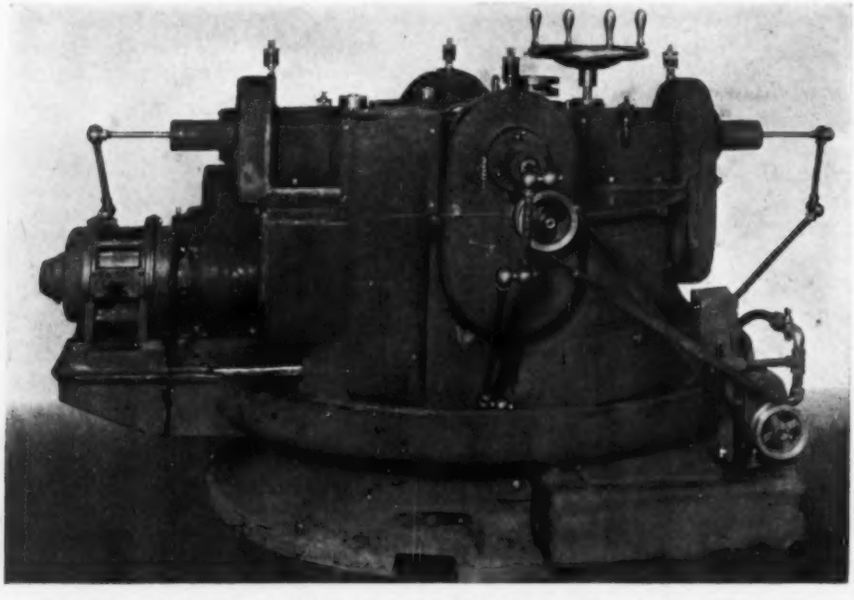
All patents relating to Ramet, its processes of manufacture, and the methods of applying it to tools are the property of the Fansteel Products Company, Inc. Ramet is sold, however, without hindering restrictions. The company is not in the tool business. For the convenience of users a limited number of toolmakers have been appointed distributors. To date these are the Illinois Tool Works, Chicago, Ill., and the McCrosky Tool Corporation, Meadville, Pa.

Reed-Prentice Nos. 1 and 2 Four-Way Drilling and Turning Machines

Drilling four holes, or turning four diameters, or milling four surfaces can be done simultaneously with the four-way drilling and turning machine announced in two models by the Reed-Prentice Corporation, Worcester, Mass. The unit is particularly applicable to automotive production on such parts as universal joint rings, differential spiders, and fan spiders. It consists of four heads mounted on the table forming the top of the bed. Each head contains a spindle driven through helical gears from four spindle drive shafts and a cluster of bevel gears inside the bed. One of these shafts extends outside of the bed where it is arranged with a tight and loose pulley, furnishing a belt drive to the entire machine. When desired, however, this shaft may be arranged for a motor drive, the motor being mounted on a bracket and power being transmitted through a train of gears. Should it be necessary to change the spindle speeds, new gears can be furnished. The spindles are free to move back and forth in the heads. Four vertical shafts, one in each head, have pinions meshing with steel racks in the spindle bearings. Four gears on the lower ends of four shafts mesh with a large central spur gear receiving its drive indirectly from the spindle drive shaft, thus providing power feed to all spindles. This drive contains a set of change gears, which provide for some changes in feeds, and any one feed within the range listed in the specifications. The upper portion of the vertical feed shaft, as arranged in connection with the left head, has a large handwheel that allows all the spindles to be moved backward and forward simultaneously. At the top of the rear head is a drum carrying an adjustable dog that rotates with the shaft sliding the spindle. As the dog travels in its circular path it comes in contact with a sliding plunger for disengaging the power feed. The spindles can therefore be tripped automatically where desired, and are brought back to their starting position by the use of the handwheel.



Turning differential spiders on the No. 2 machine. The turning tools are inserted in holders in auxiliary tool spindles held by a bayonet lock



Rear view of Reed-Prentice No. 2 Four-Way Drilling and Turning Machine arranged with motor drive, oil pump, oil reservoir, and guards

Each spindle is arranged with a sliding inner sleeve, which can be placed in any desired endwise position, regardless of the location of the spindle. The sleeves are equipped with a No. 5 Morse taper, and fixed by hardened taper bushings and clamping collars. This construction allows the cutters or drills to be set in exact relation to each other, and also re-setting of any tool after it has been re-ground. Special fixtures are required for holding the work.

A sample of the work that can be done on this machine is illustrated in the accompanying drawing. In this set-up simultaneous turning of the four diameters on differential spiders is obtained. The spider is clamped

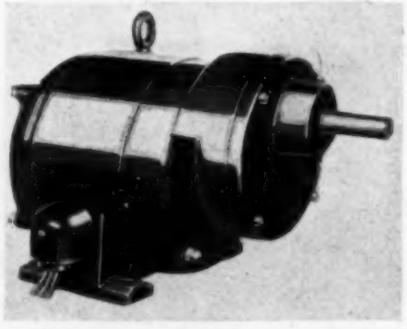
Specifications of Reed-Prentice Four-Way Machines

Size	No. 1	No. 2
Distance between heads, in	14	26
Maximum spindl travel, in	5	5
Height of spindle from table, in	6	6
Feeds per revolution, obtainable	.001 to .024	.002 to .048
Spindle speed, maximum, r.p.m.	600	600
Floor space, in	80x73	92x85
Motor, hp	5	5
Net weight, lb	6,680	8,180

on a pilot and located in relation to the tools by a swinging arm, which is removed when the tools are in operation. Turning tools are inserted in holders in auxiliary tool spindles mounted in a self-contained fixture clamped to the bed. These spindles are driven from the machine spindles by drivers arranged with a bayonet lock. The use of single-point tools permits a free cutting action without the interference of chips, while the turning of the four diameters simultaneously not only reduces the handling and machine time to a minimum, but insures accurate relationship of the diameters machined.

Master Geared-Head Motors

Motors incorporating speed reducers are available in parallel-shaft and right-angle-shaft designs from The Master Electric Company, Dayton, Ohio. The parallel-shaft type is built in sizes from 1/30 to 5 hp., in single-phase and d.c. models, and from 1/30 to 20 hp., in polyphase models, with interchangeable frames for the same horsepower and speed in different types. The parallel-shaft type is available in multiples of 0.25 for any ratio between a maximum reduction of 6 to 1 and a maximum acceleration of 2.5 to 1 of standard motor speed. It is equipped with anti-friction bearings throughout. Gears are of the continuous-tooth herringbone type. Both gears are of steel. Where quietness is essential, a composition gear can be supplied. The gear housing can be arranged so that the shaft projects in any one of four different positions—either at the top or bottom on the vertical center-line, or to the right or left on the horizontal center-line. An oil-seal arrangement is provided, necessitating lubrication only at 1,000-hour intervals of service.



Master Geared-Head Motor of parallel-shaft design, available in sizes from 1/30 to 20 hp., and employing continuous-tooth herringbone gears

The right-angle-shaft type motor is built in sizes from 1/30 to 5 hp., single-phase and d.c., and 1/30 to 10 hp., polyphase, with interchangeable frames for the same horsepower and speed in the different types. Standard ratios range from 8 to 1 to 72 to 1 in nine steps. This type is also equipped with anti-friction bearings throughout, but employs a worm-gear reduction. The worm-gear housing can be arranged so that the shaft projects in any one of eight different positions—on either side of the housing with the housing at the top or bottom on the vertical-center line, or to the right or left on the horizontal center-line. This type also has an oil-seal arrangement to minimize the necessity for lubrication.

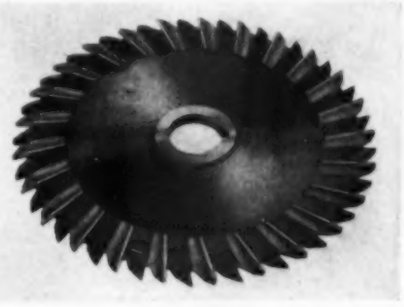
Master Geared-Head Motor of right-angle shaft design, available in sizes from 1/30 to 10 hp., and utilizing a worm gear reduction

Union End Mills and Staggered-Tooth Saws

Additions to the line of tools manufactured by the Union Twist Drill Company, Athol, Mass., comprise a two-lipped end mill, a coarse-tooth end mill, and a metal slitting saw. The two-lipped end mill is threaded for a draw-in bolt, and the coarse-tooth end mill is likewise equipped. These two tools were developed to meet the growing demand for end mills threaded for draw-in bolts. The third tool, the metal slitting saw, is provided with staggered side teeth and is recommended for deep slotting. The end mills are made up to 1½ in., and the slitting saw up to 10 in. in diameter and not thinner than $\frac{3}{16}$ in.

Union Two-Lip End Mill threaded for a draw-in bolt

Union Coarse-Tooth End Mill threaded for a draw-in bolt



Union Metal Slitting Saw with staggered side teeth, recommended for deep slotting

"Plasket" Packing Material

Three grades of a plastic, non-drying packing material, known as "Plasket" are being marketed by the A. & E. Company, 540 N. Michigan Ave., Chicago, Ill. Plasket No. 1 is for packing pipe joints, flanged or

threaded, for saturated and superheated steam, hot and cold water, air, gas, brine, and liquid ammonia. Grade No. 2 is for sealing joints where gasoline, oil, tar, paraffin and ammonia gas are present, while grade No. 3 is for general purpose use. It is said that the material will function under vibration and will withstand expansion or contraction of the adjacent parts. It is unaffected by any of the substances with which it comes in contact. Because the material remains plastic indefinitely, the joint can be demounted at any time.

Plasket comes in cans from 5 to 25 lb. It is applied with a spatula or putty knife.

Gleason Automatic, Hydraulic Roughing Machine for Spiral-Bevel Gears

Large reduction in the time required to rough spiral-bevel gears is effected by the automatic and hydralic features of the roughing machine illustrated. This unit, placed on the market by the Gleason Works, 1000 University Ave., Rochester, N. Y., embodies special safety features to minimize danger of breaking the cutter. The gears are first roughed on this machine and then finished on the Gleason spiral-bevel gear generator.

The cutter-spindle housing is bolted to the base and the work spindle housing to the frame. An overhead tie between the two heads adds to the rigidity. Motors are mounted in the machine and coupled directly. A control valve and electrical switches are grouped conveniently. Servicing can be done while the machine is in operation. The chips fall into a pan in the base where they are drained of coolant and can be easily removed.

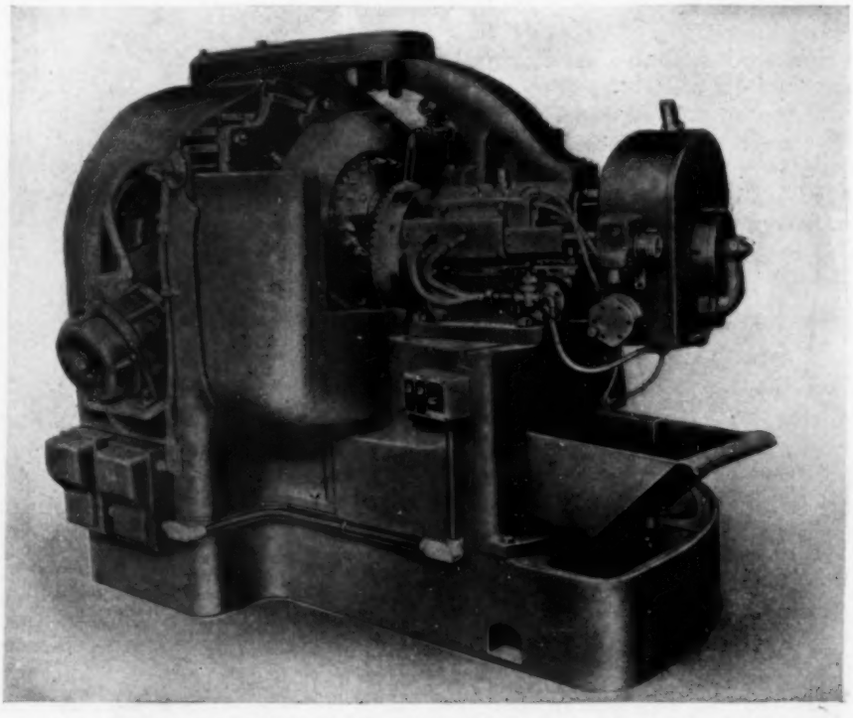
The cutter spindle is mounted in a saddle in the upright. The entire saddle assembly is adjustable both horizontally and vertically for setting the cutter to the proper spiral angle. Adjustment is also provided for taking up cutter wear. The cutter spindle is mounted on large precision anti-friction bearings, and the nose is ground to size with the spindle mounted in place. Feed movement of the spindle sleeve is actuated hydraulically. Depth of feed is varied by an adjustable stop screw, while a control valve permits changing the time per tooth hydraulically. The cutter is driven through a pinion driving an internal gear bolted to the cutter-spindle faceplate. Change gears for obtaining various cutter speeds are located conveniently. The heavy flywheel on the spindle faceplate makes for very smooth cutting.

The work head is mounted directly on the frame and has the usual angular and linear adjustments to accommodate gears of various pitch angles and cone distances. The standard spindle bore is 3.906 in. with a taper of 0.606 in. per ft. The work spindle remains stationary during the cutting operation, except when the work is indexed. When all of the teeth are roughed, the work is moved automatically away from the cutter for removing the roughed-out blank.

The hydraulic chucking mechanism is an integral part of the machine. Gears are chucked by being drawn back against a shoulder on the arbor by means of the draw rod, which extends to the back of the work spindle. Work is held in place by a spring, which is released automatically through hydraulic means when the head backs away from the cutter after the last tooth is roughed out. The draw rod is adjustable for length and the chucking mechansim (except for the arbor) can be used for any gear of standard design. The index mechanism is of the notched-plate type and is actuated hydraulically. The automatic stop, which functions after the last tooth is cut, resets itself after each blank is roughed, eliminating the possibility of recutting a tooth.

Pressure for the hydraulic system is supplied by an individual unit contained in the machine, This unit is driven by a separate motor which also drives the coolant pump. The machine is arranged for motor drive only. A standard 5-hp., constant speed motor is used for the cutter drive and a 3-hp. motor for the hydraulic unit and coolant pump. The motors are supplied by the customer or with the machine as required. Automatic lubrication is a feature.

Standard equipment furnished includes: One index plate, full set of speed change gears, cutter gage, automatic stop, and hydraulic power unit, less the motor.



Gleason Automatic, Hydraulic Roughing Machine for Spiral-Bevel Gears, which is arranged for the use of 9-, 12,- 15- and 18-in. cutters

"Regal" Engine Lathes

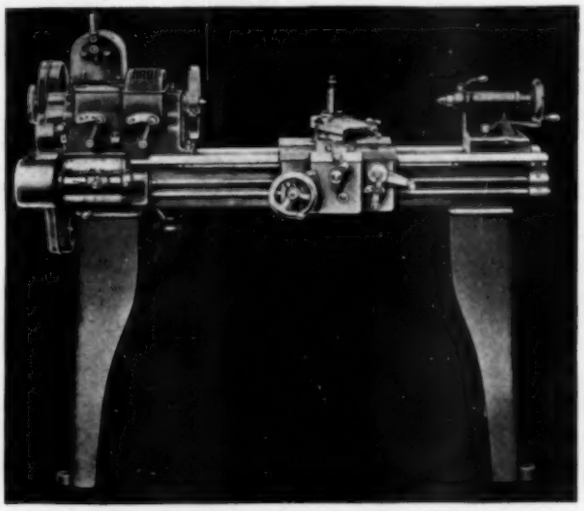
For use in general-service shops, schools, garages, experimental laboratories, and other places where light manufacturing is done, the R. K. LeBlond Machine Tool Company, Cincinnati, Ohio, has placed on the market a line of "Regal" engine lathes. Compactness of design, safety, and simplicity of control are features of the line, which is built in five sizes from 10 to 18 in. The machines are low priced and a deferred payment selling plan offers an opportunity for ready purchasing by small concerns.

The Regal lathe has an 8-speed selective-geared headstock, using heat-treated, normalized and hardened steel cluster gears. Final drive from the intermediate shaft to the spindle is through helical gears. The head is driven by a self-contained motor located at the rear and on the upper part of the leg, the drive being affected by means of multiple V-belts. The feed mechanism is strengthened where excessive strain occurs from inexperienced operators, and a safety pin is provided in the feed gear train. A feed rod takes the wear off the leadscrew, which is used only to perform chasing operations. The carriage has long bearings on the bed, with a wide, deep bridge to withstand the pressure of the tool under cut. The bed is made of close-grained iron having a nickel and steel content.

The headstock is a box casting reinforced in the main spindle bearings, with bearings cast integral for the main drive shaft and intermediate shaft. The driving shafts run in phosphor-bronze bushings fitted to the headstock and scraped. The high-carbon steel spindle has eight changes of speed obtained by sliding gears without the use of jaw clutches. Four sliding gears give four changes of speed to the intermediate shaft.

The graduated tailstock top is tongued to the bottom with provision for a set-over for taper turning. The tailstock is designed to permit the compound rest to be used parallel to it. The compound rest is gibbed to the dovetail of the carriage bridge. The cross feed screw collar is graduated to thousandths, and the compound rest swivel slide is graduated in degrees. It may be set at right angles to the cross-slide or at any angle for boring short tapers.

To guard against breakage the feed mechanism has practically the same quick-change box and apron as used on the LeBlond heavy-duty engine lathes. Frictions in the apron have been replaced by a positive, pinion-type clutch. Drive to the feed train is through a feed gear mounted on the spindle to a reverse plate carrying two tumbler gears and a reverse plate gear which swivels on the headstock casting. The reverse plate is also used for reversing the leadscrew to cut right- or left-hand threads. A slip gear on the quadrant provides two ratios of gearing to the quick-change box. Two levers are used to get 24 changes of feed, and by means of the slip gear on the quadrant 48 changes are possible. The taper attachment is mounted on the rear.



Light manufacturing can be undertaken with the "Regal" Engine, obtainable in sizes from 10 to 18 in., and purchasable on the deferred payment plan

Grant No. 4A Rotary Vibrating Riveter

Rivets from $\frac{3}{8}$ to $\frac{1}{2}$ in. can be cold-headed on the No. 4A riveting hammer announced by The Grant Manufacturing & Machine Company, 90 Silliman Ave., near Fairfield Ave., Bridgeport, Conn. This type of riveting machine is known as a vibratory hammer, the hammer spindle being caused to vibrate in a vertical direction between 1,500 and 1,800 blows per minute. The table has been made extra heavy to insure the work being rigidly supported. Raising and lowering the table a small amount is done by turning the adjusting screw in the bracket located underneath the table. For greater adjustment of the table, the adjusting bracket is moved to the next slot.

The riveting tool or peen used on this machine is threaded to fit the outside diameter of the hammer spindle. It is made from hexagon stock, as this permits the use of a wrench. Hammer-spindle bearings have been made extra long, and the hammer spindle is rotated clockwise by a worm drive located inside the spindle arm. The worm shaft is driven by a V-belt connecting with the main shaft in the rear of the machine. The hammer spindle is made from a chrome-vanadium steel forging and heat-treated to prevent crystallization from shock.

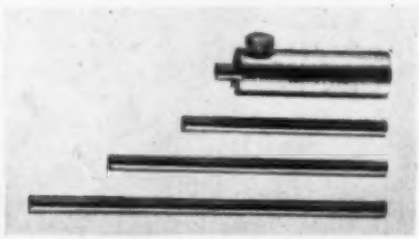
The helve is made from seasoned

hickory wood and resembles a large flat spring. It is held securely in a so-called fulcrum lever connected to the main driveshaft. The main shaft in the rear has at its center an eccentric bearing which gives the connecting rod a reciprocating motion. The connecting rod passes through the wrist pin and thrust block at the rear end of the fulcrum lever, thereby transmitting the reciprocating motion of the connecting rod from the eccentric on the main shaft to the rubber cushions, which, in turn, act on the thrust block and wrist pin, causing the fulcrum lever and helve to vibrate the hammer spindle.

The main pulley has been made to take a 1¾-in. flat belt. The clutch is of the friction type with Raybestos lining. Thrust ball bearings are used between the bronze nut on the mainshaft bearing bushing and the inner clutch plate, and also at the left side of the machine between the small pulley for driving the spindle worm and the frame. A brake is also provided to stop the hammer spindle in its uppermost position to allow the work to be inserted and removed readily. The brake is operated by a treadle rod. The machine requires a 2-hp. motor.

Brown & Sharpe No. 599 Depth Gage

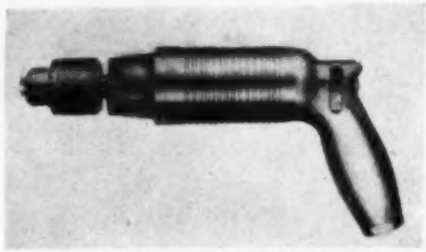
For accurately checking the depth of holes, counterbores, and distances between shoulders and flanges, the Brown & Sharpe Manufacturing Company, Providence, R. I., is introducing a No. 599 depth gage. This



tool can be adjusted for other measurements and can be used against or between very small shoulders or in shallow recesses. Depths from 0 to 2 in. by thousandths of an inch are obtained by measuring the over-all length of the body and rod with a micrometer. From this measurement is subtracted the length of the body, which is exactly 1 in. The body is hardened and ground and has a V-groove which facilitates measuring against a curved surface. If desired, the tool can be used to measure distances from 1 to 3 in. between shoulders, and where the tool is used for this purpose, the micrometer reading of the over-all length of the tool is the correct dimension.

"CP" No. 11 Midget Rotary Drill

Light weight is a feature of the ¼-in. production drill, known as the No. 11 Midget rotary, and produced by the Chicago Pneumatic Tool Company, 6 East 44th St., New York,

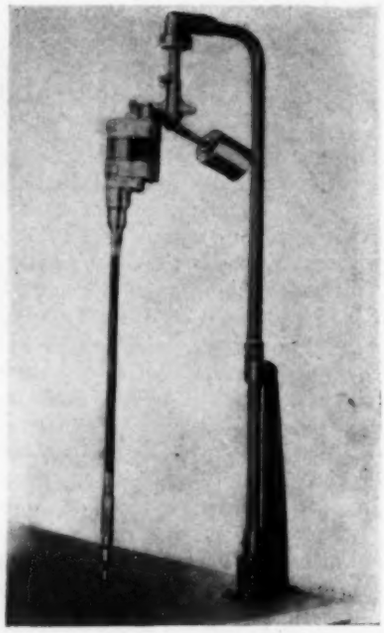


N. Y. It is adapted for drilling "tell tale" holes for use in airplane and light metal construction. The spindle is in the center of the housing, giving a "line drive" construction that makes it easy for the operator to do accurate work. Low air consumption is another feature. The chuck furnished is a ¼-in. Jacobs; the light speed is 2,500 r.p.m.; the length over-all is 9⅛ in.; the spindle offset is 1 in., and the weight is 3½ lb.

Haskins Bench-Type Nut Setter

For setting small screws and nuts, the R. G. Haskins Company, 4630 W. Fulton St., Chicago, Ill., has developed a Type CBF bench machine. This unit has a standard motor clutch and adjustable tensioning device. The motor is of the split-phase induction type. Combined radial and thrust ball bearings, fitted with grease retaining devices, are employed.

To obtain the correct speed for the bit or wrench, a pair of gears is required. The gears are entirely enclosed in a grease-packed housing. The flexible drive is supple in the



Haskins Type CBF Nut or Screw Driving Unit having a special cast-iron standard to be mounted on a bench, conveyor, side wall, or ceiling

hands of the operator, and consists of a sturdy handpiece shaped to fit the operator's hand. A quick-acting chuck is applied as well. The unit is counterbalanced on knife-edge bearings to reduce the effort on the part of the operator when centering the drive over the screw or nut being driven.

Hopkins Air-Operated Milling-Machine Vise

An air-operated "Hopkins" milling machine vise has been placed on the market by the Tomkins-Johnson Company, Jackson, Mich. The hardened jaws are removable to permit special jaws being inserted to suit the work. Slots are provided for clamping and keys are secured in the base for milling-machine table slots. The width of the jaw is 6¼ in., and the height, 1 1/16 in. Maximum distance between jaws is 4 in. Extreme height of the vise is 5¼ in., length of base, 24⅝ in., width of base, 7 in., and power stroke of jaw, ⅛ in.

"Landmaco" 1- and 1½-In. Threading Machines

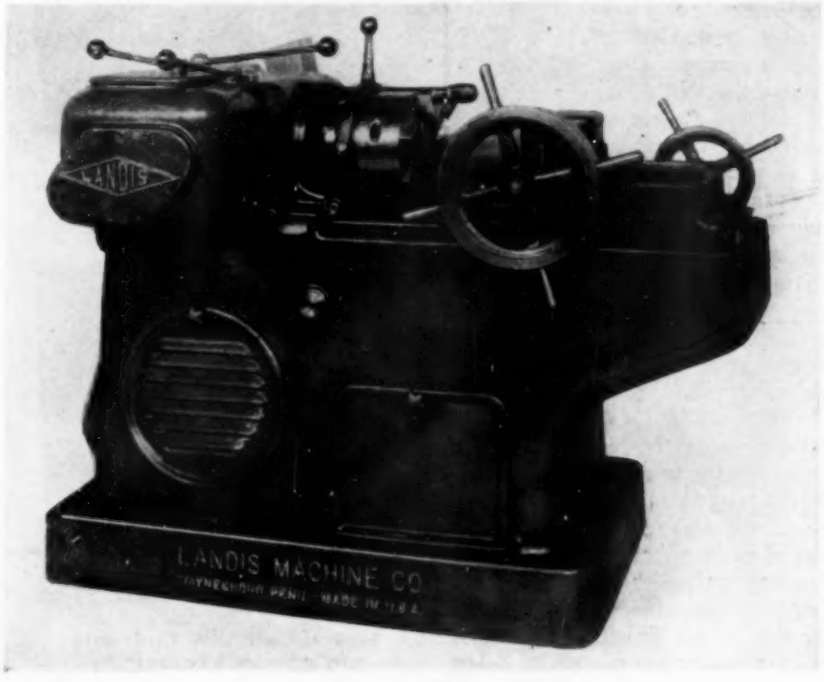
Both single- and double-head models of the "Landmaco" threading machine are being manufactured by the Landis Machine Company, Inc., Waynesboro, Pa. The machine is available in 1- and 1½-in. sizes, and has a single pulley drive with a friction clutch to start and stop the machine. The gearbox is of the selective type and has eight speeds. It is integral with the headstock and is fitted throughout with anti-friction bearings. The gears are of hardened and burnished chrome-nickel steel, and are mounted on heat-treated, alloy-steel shafts.

The double-head machines, when equipped with leadscrews, have a reversing mechanism in the gearbox for reversing one spindle. This mechanism can be supplied with the non-leadscrew machines. The spindle is driven by spiral-bevel gears. Bearings at the diehead end are large and preloaded to eliminate end play.

The diehead is placed close to the front spindle bearing to reduce overhang. The head is opened through a yoke by the forward movement of the carriage and is closed as the carriage is withdrawn. The yoke also has a lever by which the diehead may be opened or closed by hand.

The carriage is gibbed and is operated either by a rack and pinion or a lever. The vise has a horizontal sidewise as well as vertical adjustment, which makes possible accurate alignment between the diehead and the work. A low-pressure, gear-type pump is fitted. It is connected directly to the constant-speed shaft in the gearbox and will reverse automatically when the machine is reversed. The leadscrew is located centrally between the guides of the machine and takes the thrust load without binding the carriage. It is mounted on large pre-loaded ball bearings and has a coarse pitch thread with a rounded crest. The leadscrew nut is of the split, full-nut type and is made of bronze. The two segments are made exceptionally long. A third adjustable half-nut, also of bronze, is employed to take up backlash. Contact surfaces of the leadscrew and nut are lubricated automatically from a reservoir in the carriage. The pitch change gears are housed in a gearbox located at the headstock end of the machine. Intermediate gears are carried in a circular slot in the base of the gearbox.

When arranged for motor drive, the machine has the motor mounted in a compartment in the bed and connected to the main driveshaft by a silent chain.



"Hi-Duty" Drills

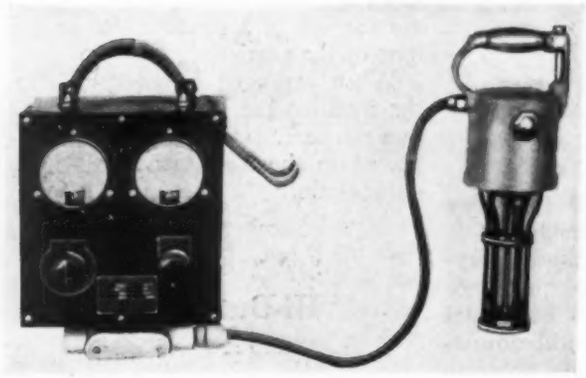
Drills ground in the web after hardening are now being marketed by the Hi-Duty Drill Works, Fleetwood, Pa. They are ground in the web to insure it being dead in the center, so that the lips do not cut large after they have been ground down to 1½ in. from the end. It is often found that drills are bowed after hardening. Some drills may be from 0.005 to 0.008 in. out of line, and in larger sizes cannot be straightened readily. Grinding the web corrects this condition.

DeVilbiss Electro-Viscometer

Rapid measurement of the viscosity of finishing materials is the function of the "Electro-Viscometer" announced by The DeVilbiss Company, Toledo, Ohio. This device indicates viscosity of paints, varnishes, lacquers, and oils in visual scale units, and to an accuracy of 2 per cent.

The viscometer measures the viscosity by rotating an impeller immersed in the liquid under standard electrical conditions. The effect of the viscosity load imposed by the liquid upon the impeller is determined by the effect upon the electrical circuit of the rotor. The scale has been designed so that the units vary for a given liquid density approximately with the logarithm of the absolute viscosity. Calibration charts are built up, permitting the conversion of the DeVilbiss units into other established units such as Saybolt seconds or Engler degrees. It is not necessary to change the liquid from one container to another and measurements can be made readily in the original container.

In operation, an attachment plug is connected to any light socket and the instrument is connected with the line by means of a snap switch. The circuit potential is adjusted to a defi-



DeVilbiss Electro Viscosimeter cabinet and motor-driven impeller for determining viscosity of finishing materials

nite value by means of a control dial and the impeller then submerged in the liquid. After depressing the push button on the handle of the impeller mechanism, the consistency of the liquid is simply read from the dial.

Hanson-Munning Electrolytic Bright-Dip Process

Rapid and thorough cleaning of rust, scale, and occluded oxides from forgings, formed articles, sheet, or coiled stock can be effected in a few minutes with the Hanson-Munning electrolytic bright-dip process. The surfaces, depressions, or interiors of steel parts are made chemically clean and of a bright silvery appearance. Beginning with a short dip in an alkaline solution to remove oil, parts move through two electrolytic baths, rinses, and acid neutralizer. Consequently, the process adapts itself to conveyor installation. Advantages are absence of fumes, steaming baths, and necessity for maintaining the equipment in separate departments, but because of the cleanliness of the operation the apparatus may be inserted in the production line-up. Suitable installations are designed by the Hanson-Van Winkle-Munning Company, Matawan, N. J.

In this process, steel is treated in two baths—cathodically in the first and anodically in the second. In the second bath, solutions are formed adjacent to the work that have a solvent action on the residual matter created in the first bath. All residue, such as carbon blacks, is dissolved and eliminated, leaving the metal bright and silvery in appearance and chemically clean.

Certain advantages derived from the use of the Hanson-Munning electrolytic bright-dip process are found in: the inspection and machining of metals; finishing of chrome-nickel alloy steel; galvanizing operations; lacquering and painting operations; and plating operations on various metals. Unpickled spots on forgings, pipe, tubing and bar stock show up as black areas against the silvery background and thus inspection for flaws can be accomplished before machining operations are undertaken. Reduction in machining time is accomplished because the tool point encounters only virgin metal and chattering is eliminated. The life of drawing dies and forming tools is lengthened because of the absence of abrasive scale, and tool marks on the final product are reduced to a minimum. In the finishing of chrome-nickel alloy steels, reduction in the wear of forming tools is obtained, and also reduction in the number of grinding or polishing operations to achieve the desired finish. In galvanizing operations the process removes the scale so that zinc coatings will be more uniform in depth and more homogeneous in structure. In lacquering, painting, and enameling operations, a microscopic bit of oxide will cause an enameled surface to pit badly in the baking oven and, once pitted, an enameled stamping cannot be salvaged. Furthermore, the weather resistance of painted surfaces is proportional to the adherence to the metal, and consequently the process will increase the life of products.

Since occluded oxides are entirely removed from the surface of steel treated by the electrolytic bright-dip process, electro-plated finishes form a continuous, closely adherent layer and there are no foci for corrosion to emanate from to peel off the plate. Furthermore, in the preparation of metals for plating it will be only necessary for the grinding operation to smooth off the rough surface. This effects economies, since it is often necessary to take several cuts in ordinary practice to remove thoroughly all traces of scale and oxides.

Above—Axe head covered with hard scale
Below—Scale entirely removed by the process

Ex-Cell-O Semi-Automatic Boring Mill for Wire Wheels

The Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich., has announced a semi-automatic machine for boring and turning two diameters, forming two peripheries, and facing the hub face of wire wheels. The wheel is placed on a rotating table and centered by a shouldered pilot in the upper vertical unit. This unit is rapid traversed downward by means of a large handwheel to an indicated stop and locked. The pilot is mounted on ball bearings and is backed up by a heavy spring, so that the required pressure can be exerted for holding the wheel in place. The stop consists of a roller which rides on the hub of the wheel proper and enables the operator to set the cross-slide, which is carried on the upper vertical unit in order to remove the minimum amount of stock for trueing the hub.

With the upper vertical unit in this position, the feed is thrown in by means of a hand lever at the center of the machine. The cross-slide then finishes the hub face and forms a radius on the periphery of the hub flange. Simultaneously, the lower vertical unit is fed up automatically to bore the opposite end of the hub with a circular form tool. The lower unit travels upward until the boring is completed, at which time a roller comes in contact with the lower face of the hub. This roller follows the run out of the hub, and keeps the chamfering tool, which is fed automatically in a horizontal direction, true with the lower face of the hub, thereby insuring a symmetrical chamfer. When the chamfer is completed, the lower unit comes to rest at the downward end of the stroke, and the upper unit is released and fed upward to the end of its stroke.

Between 65 and 70 steel wire wheels per hour are bored, turned on two diameters, formed on two peripheries, and the hub faced on this Ex-Cell-O Semi-Automatic Machine

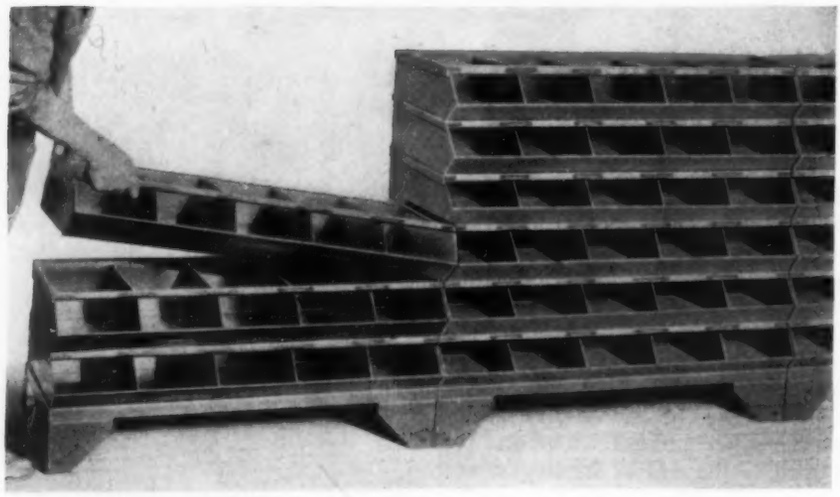
Eda Model 10-B Power-Operated Turret Punch

The Eda turret punch manufactured by the Wiedemann Machine Company, 1815 Sedgley Ave., Philadelphia, Pa., has now been mounted in a power machine, known as the model 10-B. This machine provides a pressure of 60,000 lb. and punches a 1-in. hole in $\frac{3}{8}$-in. boiler plates. The 12 punches and dies range from $\frac{5}{16}$ to 1 in. and are the same and interchangeable with the 8-B punch. Dieholders on the 10-B model are somewhat longer to accommodate special cutting and bending dies if needed. A handwheel is provided to locate the punches as required. The model 10-B can be supplied in stationary or portable models and in belt or motor-driven models. The portable base of the press provides ample room for the motor and switch.

The press requires a 3-hp. motor. At a speed of 500 r.p.m., the flywheel gives the press 26 strokes per minute. Depth of throat is $4\frac{1}{2}$ in., and the clearance between the dies and strippers is $\frac{9}{16}$ in. The machine occupies a floor space of 39x35$\frac{1}{2}$ in., and the height with the base is 64$\frac{1}{2}$ in. The net weight is 2,000 lb.

Simplex Stockroom Bin Sections

Either temporary or permanent stockroom bins can be built up like a sectional bookcase by the employment of the Simplex stockroom bin sections, which are available in four standard sizes. These bins, announced by the Simplex Tool Company, Woonsocket, R. I., are not bolted together and thus may be easily moved or rearranged. Each section nests deeply into the one be-



Illustrating ease of building up stockroom bins with Simplex bin sections

low, and is of sufficient width and depth so that several nested together make a substantial unit. The base shown is separate from the section itself, and a top can be furnished to serve as a counter, or as a shelf when large and small sections are assembled, in which case the larger sections are used up to the counter height, and smaller sections from there on up.

The standard sizes are as follows: Depth 12 to 20 in.; height 4 to 9½ in., and width, 37 in. in all cases. Each section is divided into a number of bins, there being a maximum of six. The width may be changed to suit requirements, and special size sections may be obtained. Each bin has a cardholder for description of the contents.

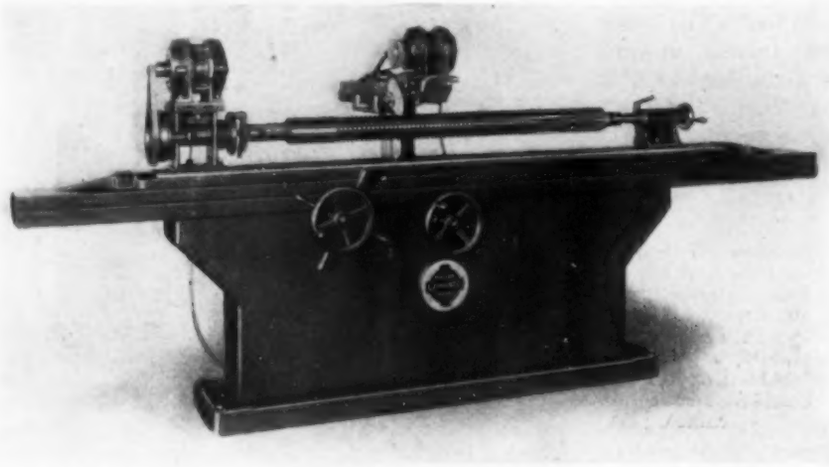
Heavy gage metal is used for the body and bin dividers, and sharp edges that might catch the hand have been avoided. In addition, the design of the bottom is such that bins can be cleaned out easily. Sections are lacquered in green.

LaPointe Broach Sharpening Machine

Capacity to take 60 in. between centers is embodied in the broach sharpening machine announced by The LaPointe Machine Tool Company, Hudson, Mass. The swivel head can be set for face grinding the teeth of a broach revolved on centers. The swivel head slide and table roll on ball bearings mounted between the hardened and ground steel ways. Reduction of friction by use of ball bearings in these parts provides an easy moving table and slide, particularly when a heavy broach is being sharpened. The grinding spindle is also mounted on ball bearings and can be turned in any position necessary to give the proper cutting angle to the broach teeth.

For grinding cutter-bars, rectangular or square broaches on the face of the teeth, a dish wheel is used. The swivel head slide can be turned in a horizontal plane so that rectangular or square broaches with the teeth cut on an angle can be sharpened. The swivel head is provided with a handle by which the grinding wheel is moved back and forth across the face of the teeth. Adjustable stops are provided to govern the movement of the cross-slide.

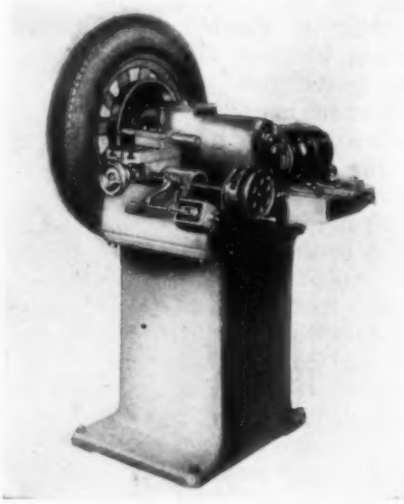
Specifications: Speed of grinding spindle, 3,870 r.p.m.; speeds of headstock spindle, 500 and 300 r.p.m.; vertical adjustment of column, 13 in.; size of grinding wheel for facing, 5 x ½ in., dish, ½-in. hole; size of the cup wheel for grinding clearance on broach teeth, 3 in. x ½-in. hole; cross-travel of wheel, 10 in.; longitudinal travel of table, 56 in.; height of machine, 60 in.; floor space required, 17 ft. x 50 in.; net weight, 3,900 lb.



Broaches up to 60 in. long can be sharpened on this LaPointe Machine

"Raybestos" Super Drum Lathe

Improvements have been made in the "Raybestos" drum lathe manufactured by the Reed-Prentice Corporation, Worcester, Mass. These improvements are as follows: Out-



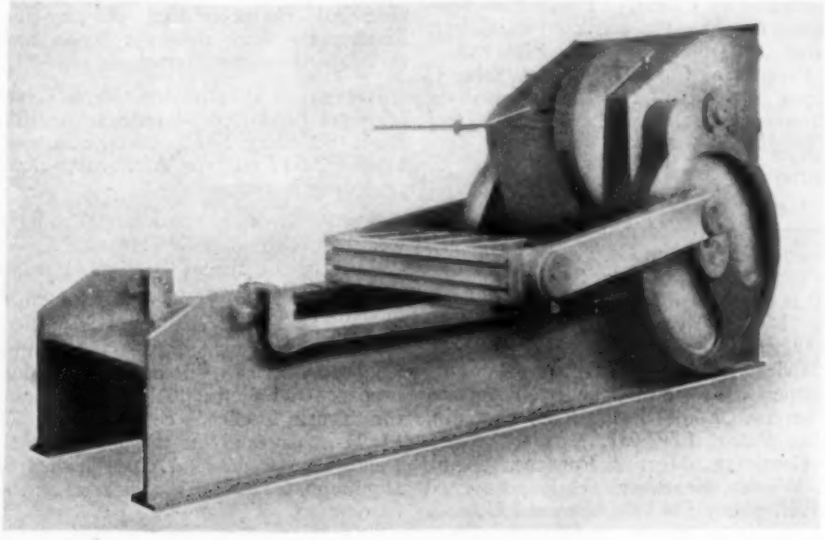
board supports insure accurate alignment; control switch and adjustable stop; ratchet feed with hardened parts; ¾-hp. motor for feed and 3-speed drive; five feeds, 0.003, 0.006, 0.009, 0.012, 0.015 in.; removable cover for inspection or lubrication of gears; 3½-in. graduated dial on cross feed; rigid base and column, and maximum feed of 9 in.

The Raybestos drum lathe is offered in the Model C for passenger cars, Model D for passenger cars and trucks, and Model E for trucks and buses. The use of a rubber driving belt and worm gearing provides a smooth drive.

"Battleship" Bulldozers

Welded steel plate construction is employed in the line of "Battleship" bulldozers announced by the Steelweld Machinery Company, Cleveland, Ohio. Heavy members of rolled steel form the die-holding base and are carried back to the steel-jacketed main bearings. On these members are mounted the hardened and ground steel bearing plates forming the ram slides. All gearing is of steel with cut teeth, and the driving mechanism, together with the motor, is entirely enclosed in the main frame. Drive is by means of cog-belts. The undergibbing for the ram has a single take-up designed so that it will not catch dirt and chips. Side arms are of steel and together with the main bearings are bronze bushed.

Through the steel ram is welded a solid shaft so that trouble from broken end lugs is eliminated. Timken bearings are employed in the flywheel and the high-speed shaft. The main clutch is of twin-disk design, and the tool is arranged for one-shot lubrication. Reversing clutches are standard in larger sizes. Electrical clutch control is optional equipment on all machines and affords time saving means in production work.



PATENTS

February 10, 1931

Metal-Working Machinery

Riveting Machine. Conrad Knoth, Hillside, N. J., assigned to General Motors Corporation. *Patent 1,791,505.*

Semi-Automatic Drill and Tapping Jig. Eugene L. Oberly and Henry Hansen, Chicago, Ill. *Patent 1,791,532.*

Transmission and Control Mechanism for Milling Machines. Fred A. Parsons, Milwaukee, Wis., assigned to Kearney & Trecker Corporation. *Patent 1,791,534.*

Bending Machine. Robert L. Hibbard, Bellevue, Pa. *Patent 1,791,620.*

Centerless Grinder. John E. Caster and Lester F. Nenninger, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. *Patent 1,791,713.*

Machine-Tool Transmission. Joseph B. Armitage, Wauwatosa, Wis., assigned to Kearney & Trecker Corporation. *Patent 1,791,747.*

Die-Fitting Machine. Rudolph W. Glasner and Fredrich J. Rode, Chicago, Ill. *Patent 1,791,757.*

Milling Machine. John W. Goetz and Lawrence J. Radermacher, West Allis, Wis., assigned to The Kempsmith Manufacturing Co. *Patent 1,791,758.*

Means for Assembling Wire Wheels. Moses W. H. Wilson, East Lansing, Mich., assigned to Motor Wheel Corporation. *Patent 1,791,781.*

Apparatus for Sizing Bushings. Albert H. Valentine, Dayton, Ohio, assigned to Moraine Products Co. *Patent 1,792,051.*

Machine for the Manufacture of Steel Chain. Gustaf Barkstrom, deceased, Hinsdale, Ill., assigned to The Locke Steel Chain Co. *Patent 1,792,061.*

Welding Machine. Claude A. Bowlus, Birmingham, Mich., assigned to Chrysler Corporation. *Patent 1,792,066.*

Machine for Rolling Sheet-Metal Shapes. Albert Rafter, Belleville, N. J., assigned to Albert Rafter and John C. Rafter, Jr. *Patent 1,792,122.*

Tools and Attachments

Cylindrical Honing Tool. William F. Emerson, Williamsville, N. Y. *Patent 1,791,491.*

Pipe Reamer. William W. Vosper, Toledo, Ohio, assigned to The Toledo Pipe Threading Machine Co. *Patent 1,791,649.*

Combination Tool — Level, Square, and Scale. Emmett L. Johnston and Robert Lloyd Green, Roanoke, Va. *Patent 1,791,817.*

Counterboring Tool. Alfred J. Berg, Rockingham, N. H. *Patent 1,791,998.*

Hack Saw. John Maly, New York, N. Y. *Patent 1,792,024.*

Indicator Gauge. Lino Scusa, Phoenix, N. Y. *Patent 1,792,043.*

Apparatus for Pouring Metal in Molds. Frank G. Carrington, Anniston, Ala., assigned to Ferric Engineering Co. *Patent 1,792,069.*

Forming Die. Alfred Johnson, South Bend, Ind., assigned to The Studebaker Corporation. *Patent 1,792,224.*

Apparatus for Radially Contracting and Elongating Metal Cylinders. Frederick C. Langenberg, Edgewater Park, N. J. *Patent 1,792,229.*

Abrasive Wheel. John R. Gammeter, Akron, Ohio, assigned to The George W. Perks Co. *Patent 1,792,083.*

Attachment for Cutting Torches. Charles Frederick Marsh, Toronto, Ontario, Canada. *Patent 1,792,317.*

Processes

Method of Forming Radiators. Reuben N. Trane, La Crosse, Wis. *Patent 1,791,517.*

Welding Method. Harry J. Morgan, Walnut Park, Calif., assigned to P. L. & M. Co. *Patent 1,791,968.*

Furnaces

Metallurgical Furnace. Fred H. Loftus, Pittsburgh, Pa. *Patent 1,792,021.*

Heat-Treating Furnace. Ralf Smyth Cochran, Toledo, Ohio, assigned to The Surface Combustion Co. *Patent 1,792,074.*

Apparatus for Enameling Articles. John C. Cromwell, Alliance, Ohio, assigned to The Steel Sanitary Co. *Patent 1,792,284.*

Counterflow Furnace. Veit A. Hain, Chicago, Ill., assigned to George J. Hagan Co. *Patent 1,792,423.*

Furnace Arch and Blocks. Nick T. Puvkett, Indianapolis, Ind., assigned to The M. A. Hofft Co. *Patent 1,792,446.*

Metal-Treating Furnace. Charles T. Willard, Roselle, and Richard Kaier, Cranford, N. J., assigned to The Singer Manufacturing Co. *Patent 1,792,456.*

FEBRUARY 17, 1931

Metal-Working Machinery

Shearing Machine. Arthur T. Yates, Buffalo, N. Y., assigned to Buffalo Forge Co. *Patent 1,792,522.*

Riveting and Punching Machine. Andrew O. Wisti, Minneapolis, Minn. *Patent 1,792,790.*

Threading Machine. William Cameron, Chicago, Ill., assigned to Cameron Can Machinery Co. *Patent 1,792,812.*

Portable Boring Machine. Maurice C. Cox and Ralph B. Ryan, Oakland, Calif., assigned to Ryco, Incorporated. *Patent 1,792,820.*

Molding Machine. Robert F. Ringle, Zelienople, Pa. *Patent 1,793,012.*

Art of Molding Sheet Metal. Edmund B. Carns, New York, N. Y., assigned to Cairns Development Co. *Patent 1,793,054.*

Die-Casting Machine. Franz Ferdinand Mantel, Stuttgart, Germany, assigned to Friedrich Joseph Haàs, Stuttgart, Germany. *Patent 1,793,110.*

Pneumatic Power Hammer. Ralph E. Bates, West Medford, Mass., assigned to Williams, White & Co. *Patent 1,793,206.*

Rotary End - Trimming Shears. Florence C. Biggett, Jr., Crafton, Pa., assigned to United Engineering & Foundry Co. *Patent 1,793,208.*

Apparatus for Making Welded Pipe. John W. Free, Aliquippa, Pa., assigned to Jones & Laughlin Steel Corporation. *Patent 1,793,218.*

Multiple-Spindle Drilling Machine. William Harold Miner, Springfield, Mass., assigned to Baush Machine Tool Co. *Patent 1,793,239.*

Spiral-Pipe-Forming Machine. Jonathan R. Freeze, Middletown, Ohio, assigned to The American Rolling Mill Co. *Patent 1,793,281.*

Barrel-Forming Machine. Robert J. Bell, Jacksonville, Fla., assigned to R. J. Bell Company. *Patent 1,793,351.*

Method and Apparatus for Forming Metal Barrels. Robert J. Bell, Baltimore, Md., assigned to R. J. Bell Co. *Patent 1,793,352.*

Tools and Attachments

Jig for Connecting Rods. Frank U. Paulins, Pontiac, Mich. *Patent 1,792,506.*

Hob. Carl G. Olson, Chicago, Ill., assigned to Illinois Tool Works. *Patent 1,792,548.*

Metal-Spraying Apparatus. William S. Rice, Chicago, Ill., and Charles Marshal Saeger, Jr., Washington, D. C. *Patent 1,792,551.*

Lapping Device. Conrad F. Birgbauer, Detroit, Mich. *Patent 1,792,800.*

Cutter Head for Boring Bars or the Like. Floyd S. Hartwell, Syracuse, N. Y. *Patent 1,792,905.*

Thread Gauge. Henry Skarl, Cleveland, Ohio, assigned to Hanson-Whitney Machine Co. *Patent 1,792,936.*

Method of Making Trimming Dies. William V. Lozier, Elmira, N. Y., assigned to The Willys-Morrow Co. *Patent 1,792,994.*

Apparatus for Closing Sheet-Metal Channel Members. Lawrence S. Lamb, Detroit, Mich., assigned to Hudson Motor Car Co. *Patent 1,793,222.*

Tap Holder. Bernard Louis Smeuninx, Springfield, Mass., assigned to Baush Machine Tool Co. *Patent 1,793,259.*

Welding Mask. Walter E. Johnston, Youngstown, Ohio. *Patent 1,793,286.*

Processes

Bearings and Methods of Making Them. Henry L. Barton, Detroit, Mich., assigned to General Motors Research Corporation. *Pctent 1,792,565.*

Method of Heat-Treating Iron and Steel Sheets. Herbert M. Cox, Canton and Cary M. Smith, Massillon, Ohio, assigned to Republic Steel Corporation. *Patent 1,792,573.*

Method For Producing Light Metal Pistons Running in Cylinders of Harder Material. Fritz Fehrenbach, Baden-Baden, Germany. *Patent 1,792,580.*

Method and Apparatus for Determining Thickness of Metal Coatings. Wesley A. Richards and Paul H. Kramer, Detroit, Mich. *Patent 1,792,606.*

Pickling Bath and Inhibitor Therefor. Edwin C. Wright, Ellwood City, Pa., assigned to National Tube Co. *Patent 1,792,958.*

Method and Apparatus for Plating Metallic Surfaces. Edward O. Dunkley, Richmond, Calif. *Patent 1,793,069.*

Pickling Metals. Vanderveer Voorhees, Whiting, Ind., assigned to Standard Oil Co. *Patent 1,793,146.*

Method of Casting. Edward R. Williams, Latrobe, Pa., assigned to Vulcan Mold and Iron Co. *Patent 1,793,268.*

Process of Case Hardening. John J. Egan, Brooklyn, N. Y., assigned to Electro Metallurgical Co. *Patent 1,793,309.*

Furnaces

Metallurgical Furnace. Joseph Harrington, Riverside, Ill., assigned to Joseph Harrington Co. *Patent 1,792,638.*

Method of Heating Salt Baths for Heat - Treatment of Metals. Arthur E. Bellis, Branford, Conn. *Patent 1,792,674.*

Brick For Furnace Arches of the Suspended Type and the Arch Formed Thereby. Louis S. Trachsel, Franklin, Pa. *Patent 1,793,031.*

Continuous-Heating Furnace. Frank J. Winder, Brackenridge, Pa., assigned to Allegheny Steel Co. *Patent 1,793,037.*

Furnace. Ralf S. Cochran, Toledo, Ohio, assigned to The Surface Combustion Co., Incorporated. *Patent 1,793,209.*

TRADE PUBLICATIONS

BUFFING WHEELS. The U. S. Department of Commerce, Bureau of Standards, has issued Simplified Practice Recommendation R115-30 entitled "Full Disk Buffing Wheels." Copies are available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at $0.05.

GAGE BLANKS. The U. S. Department of Commerce, Bureau of Standards, has issued Miscellaneous Publication No. 100, which is entitled "Plain and Thread Plug and Ring Gage Blanks," a recommended commercial standard as adopted by The American Gage Design Committee. It is for sale by the Superintendent of Documents, Washington, D. C., for $0.15.

GEAR-TOOTH GAGE. The Ohio Gear Co., East 179th St., Cleveland, Ohio, is distributing a gear-tooth gage made of celluloid and of pocket size. It has correct outlines for all gear teeth from 6 to 48 D.P., stamped around the edges.

IRON & STEEL LITERATURE. The Carnegie Library of Pittsburgh, Pittsburgh, Pa., has published a "Review of Iron and Steel Literature for 1930" by E. H. McClelland, technology librarian. It is a classified list of the more important books, serials, and trade publications during the year, with a few of earlier date.

MOTORS. The Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo., is distributing bulletin 169, which discusses the mechanical and electrical characteristics of slip-ring motors, the four different types, and their speed-torque characteristics.

RECORDING INSRUMENTS. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has available Leaflet 20512 on type A, circular-chart recording instruments.

SPRINGS. The Hardware Products Co., 103 Richmond St., Boston, Mass., has prepared a list of "Preferred" sizes of springs, the catalog representing a tabulation of data.

TRUCK BODIES. The Aluminum Co. of America, Pittsburgh, Pa., has prepared a bulletin, "Alcoa Aluminum for Truck Bodies," consisting of 88 8½x11-in. pages giving the operating and weight-saving data on truck bodies of aluminum, together with material on the fabrication.

NEWS OF THE WEEK

Fourteen Rochester Firms Adopt Job Insurance

FOURTEEN of the largest Rochester (N. Y.) industries joined on Feb. 17 in an unemployment insurance program to enable industries to bear most of the burden in the event of another business depression. The plants, employing about 26,000 workers, include the Taylor Instrument Co., Consolidated Machine Tool Corporation, Gleason Works, Davenport Machine Tool Co., Yawman & Erbe Manufacturing Co., Sargent & Greenleaf, Inc., Eastman Kodak Co., Bausch & Lomb Optical Co., Stromberg-Carlson Telephone Manufacturing Co., Rochester Telephone Corporation, Todc Co., Pfaudler Co., Vogt Manufacturing Co., and Cochrane Bly Co. Other plants may join.

The plan, believed to be the first of its kind in any city in the United States, calls for a reserve fund set up by the industries over a period of five years. No contributions are to be asked from employees except in event of emergency, when those not receiving benefits will be called upon to contribute 1 per cent. The companies, under the plan, will match such contributions in that event. The companies will reserve up to 2 per cent of their payrolls each year until the reserve fund equals five annual appropriations. By a substantial reserve, the companies point out, unemployment distress can be met without compulsory or government insurance. Those eligible to receive benefits will be employees in service more than a year and receiving less than $50 a week. Benefits will equal, in general, 60 per cent of normal pay, with a maximum of $22.50 a week.

Officers of the Industrial Management Council, of which the signing firms, with two exceptions, are members, and under whose auspices the Rochester Unemployment Benefit Plan has been set up, are: Chairman, James E. Gleason; vice-chairmen, Frank W. Lovejoy and M. Herbert Eisenhart; manager, A. Edwin Crockett. M. B. Folsom, Assistant Treasurer of the Eastman Kodak Co., and Roland B. Woodward, Executive Vice-President of the Rochester Chamber of Commerce, participated in the conference leading up to the agreement.

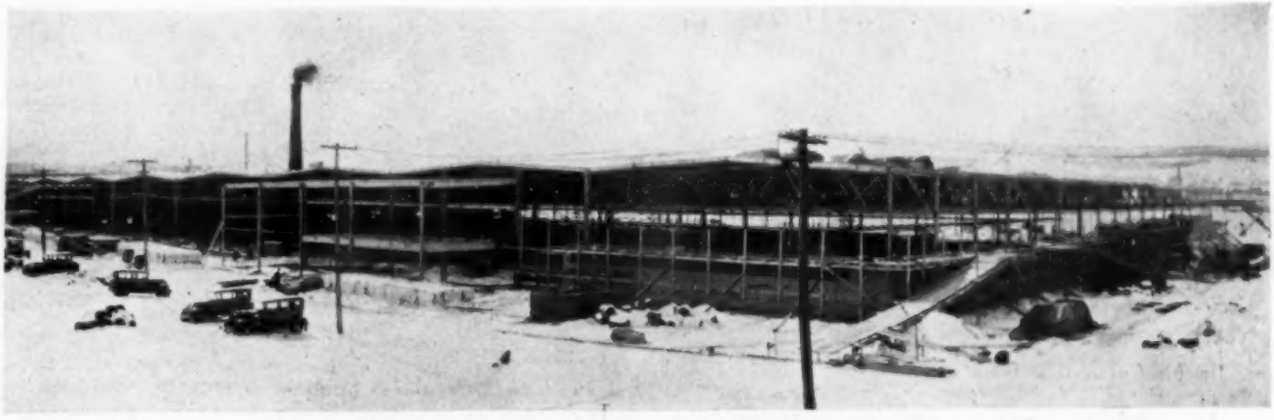
Plan to Formulate Welding, Chain, Standards

The formulation of standards for electric welding apparatus, including definitions of terms, classification, rating, heating, efficiency, testing methods, dielectric test, standard values of current and voltage, and nameplate data is the proposed scope of new project under the sponsorship of the A.I.E.E. and the National Electrical Manufacturers' Association. The proposed committee, which will operate under the direction of the A.S.A., includes F. M. Farmer, Chairman; J. L. Wilson, F. McVittie, A. M. Candy, J. W. Owens, F. H. Frankland, Lem Adams, N. M. Loney, Frank P. McKibben, W. Spraragen, E. Vom Steeg, A. B. Morgan, James Burke, L. D. Meeker, F. W. Ells, W. W. Reddie, Alexander Churchward, Lt. Com. N. L. Rawlings, H. A. Woofter, and R. S. Donald.

Personnel of the Sectional Committee on Transmission Chains, Sprockets, and Cutters has been reported by the A.S.A. The scope of the project is the formulation of American Standards for transmission roller chains and sprocket teeth, based on the standards already adopted by the S.A.E., A.S.M.E., and American Gear Manufacturers' Association; and the study of the possibilities of standardizing the so-called silent type of transmission chains and sprockets. F. V. Hetzel is chairman of the committee and G. M. Bartlett is secretary. The remaining members are H. H. Kerr, Eric Geertz, L. V. Ludy, E. B. Nichols, H. E. McCray, W. H. Worthington, O. B. Zimmerman, W. F. Cole, W. J. Belcher, M. C. Horine, G. A. Young, F. L. Morse, E. J. Opie, Joseph Joy, and J. F. McCann.

Foundry Congress To be Held in Italy

General plans are now being prepared for the 1931 meeting of the International Foundry Congress, which will open Sept. 12 at Milan, and will afterward visit Turin, Genoa, and Rome, according to advices received in the Department of Commerce from Assistant Commercial Attaché, A. A. Osborne of Rome. Provision will be made for visiting points of technical and tourist interest in the neighborhood of the cities listed, and for special railroad rates to tourists who wish to travel further in Italy. The Milan program will include an exposition of raw materials, castings, foundry machinery and equipment, and technical exhibits. Factories, ports, mines and other places connected with mineral and metal interests have been listed among points to be visited by the delegates before the formal closing on Sept. 27.



Welded steel work on industry's first "Controlled Conditions" plant, being built by the Austin Company, Cleveland, for the Simonds Steel Industries at Fitchburg, Mass., is nearly complete. The building is a new departure in factory design with its absence of windows and its artificial lighting, heating, and ventilation, described some time ago in *American Machinist*

1930 Machine Tool Trading Shows Decline in Britain

By Our London Correspondent

A GENERAL decline occurred in the value of British foreign trading last year, imports (£1,044,840,000) falling by about 176 million pounds sterling, exports of British productions (£570,553,000) dropping by more than 158¾ million pounds, while re-exports, that is exports of imported merchandise (£86,980,000), declined by about 22¾ million pounds. Deducting re-exports from imports, it will be noticed that the value of goods received and retained and of goods sent out fell away by practically equal values. Imports wholly or mainly manufactured were valued at nearly 307½ millions, a decline approaching 27 millions. In the corresponding exports, the total value was about 439¾ millions, a drop of 134 millions, or more than 20 per cent, as compared with 1929. Of this decline, about 64 millions, or roughly half, was due to loss of trading in cotton and woolen manufactures. Machinery exported was valued at about 7½ million pounds less than the year previous, and exports of electrical goods declined by about 1¼ millions. Prices also fell, the decline of wholesale prices during the year being more than 10 per cent.

As usual, the European edition of *American Machinist* has obtained from the Board of Trade a special return of British overseas trading in machine tools for 1930. The value of the exports was £1,856,226, a decline as compared with the year previous of about £297,000. Machine tool imports were valued at £1,713,458, a decline of nearly £238,000. Re-exports, at £52,337, declined by rather more than £20,000. The result is that, after deducting net imports, the balance of exports over imports in machine tools was about £195,000. Despite the general fall in prices, on the ton-value basis, British machine tool exports remained stationary, the average being £133, which is about the same as the previous year. The ton-value of imported machine tools fell from £176 in 1929 to £156, and re-exports on the same basis averaged £206, as against £194 in 1929.

The increasing importance of the European continent to British machine tool makers comes out in the official returns. Of total exports of £1,856,226, £902,127 is accounted for by this market. In four years the value sent there has more than doubled. On the other hand, the more or less British area formed by the Union of South Africa, British India, and Australia separately and together make a declining market; indeed in this respect British India and Australia have been steadily falling away for some years. These three areas took machine tools to the value of £390,191, about one-fifth of the total. Yet in 1926 British India and Australia alone took about one-half. Generally, on the ton-value basis, planing and shaping machines, (except imports) and punches and presses, are lowest, grinding machines are highest.

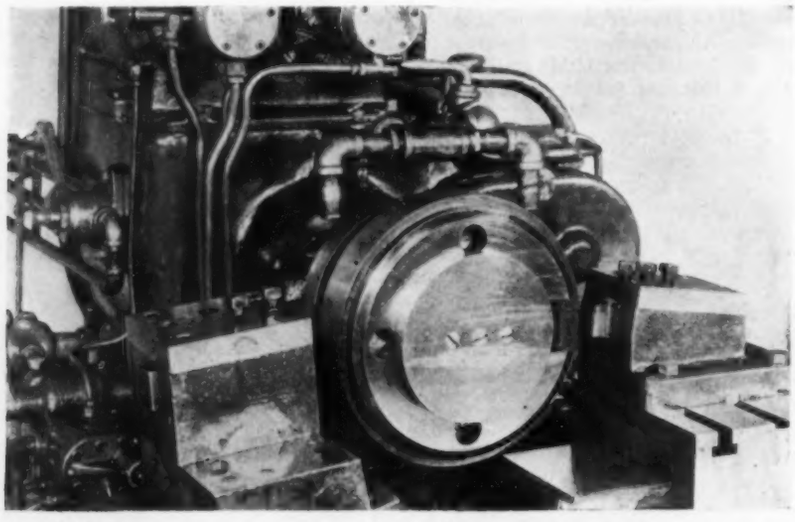
Reduction in manufacturing activities is further shown by the figures for iron and steel production, The total production of pig iron in 1930 being 6,196,800 tons and of steel ingots and castings 7,298,500 tons, declines respectively of 1,392,500 tons and 2,337,700 tons, as compared with 1929. It is true that electricity generation by authorized undertakings increased by 5.6 per cent, but even this was something of a disappointment as a 10 per cent growth had been anticipated. Altogether we are being educated to expect a very hard year of it, the easiest of our business soothsayers refusing to envisage real signs of improvement before next fall.

Business in the machine tool industry has shown a downward tendency for some little time, a matter of no surprise in view of general conditions. In particular, manufacturers of heavy tools, which cannot easily be built to stock, are steadily getting short of work, for shipbuilding yards show little tendency to order and the railway companies are economizing as far as possible. The motor car industry is ordering mainly, but not entirely, for replacement, the commercial vehicle section forming the better customer for machine tool firms. Another historical machine tool firm is to go out of existence.

It was announced some time ago that certain machine tool firms associated for the purpose of export, and also for the pooling of technical information, had reached an agreement to supply to the Russian authorities tools to the value of about £600,000, satisfactory credit facilities having been obtained. Some of the firms have now received definite orders, mostly for standard productions, but their cost will reach only a part of the total named. Other orders are to follow. Indeed, the total sum mentioned is not the limit of the possibilities of the scheme.

The general unsatisfactory condition of "engineering" in this country and a discussion of the causes formed the background recently of a special report issued by the Engineering & Allied Employers National Federation, special reference being made to the causes of high costs, including wages, taxation, local rates, trade union restrictions, and difficulties or costs caused by legislation, and a conference between representatives of employers and employed has been held.

In view of world conditions, a number of British shipyards are held to be redundant. A company has, therefore, been formed by the leading shipbuilders, the purpose of which is to purchase and dismantle obsolete and unnecessary shipyards, the sites being sold for other than shipbuilding purposes. The result, it is claimed, will be increased output in the yards remaining, with lower working costs and consequently increased ability to compete with foreign firms. The shipbuilders concerned, who are claimed to represent essentially the whole shipbuilding industry of Great Britain and Ireland, will pay the company a levy of 1 per cent of the contract or sale price of vessels contracted to be built, vessels less than 300 ft. in length being excluded. It is held that the economies effected will more than pay for the levy.



Alloy steel forgings (4% Ni, 1.5% Cr; tensile strength 200,000 after anneal) are here being turned on a production basis with the new Barnes No. 17 hydraulic-feed automatic lathe and Carboloy tools.. The Timken bearing cup is turned, faced, and chamfered in single cuts. Outside diameter, held to 0.0015-in. limits, is achieved by one ¼-in. cut. The speed is 340 s.f.p.m., the feed 0.030 in. per rev.

International Chamber to Discuss Soviet Marketing Practices

PAUL WOOTON
Washington Correspondent

WASHINGTON, D. C., Feb. 20 — Soviet Russia's marketing practices are expected to be one of the chief subjects discussed at the sixth annual Congress of the International Chamber of Commerce in Washington, May 4. All phases of business relations with Russia probably will be taken up. The other subject scheduled for discussion is the steps which can be taken to speed up business recovery throughout the world.

There was a practical understanding at the meeting of the Council of the International Chamber of Commerce in Paris, Dec. 3, that the Washington meeting would be devoted largely to the determination of the chief causes of the decline in world trade and the remedies that might be applied. It was recognized, however, that Russian policies would have an important bearing on the question.

Forty-six countries are represented in the membership of the International Chamber. Russia is not one of the countries participating in the work of the organization.

Having secured a favorable vote in the Senate, those supporting legislation to establish a national engineering museum are bending their efforts toward getting the House to act before adjournment. Due to the fact that the present building housing industrial and engineering exhibits will be demolished in carrying out the Government's construction program, it will be necessary to provide other accommodations for the displays.

The legislation dealing with the situation authorizes the appointment of a commission to study and report on the best method of providing for the industrial and engineering exhibits now owned by the Government. During debate prior to the passage of the bill in the Senate, it was brought out that the Federal authorities have been obliged to refuse many gifts of interesting and important exhibits because the present building has been unable to accommodate them.

Coffin Awards Made To 38 G.E. Employees

Employees' ideas, resulting in contributions to the progress and efficiency of the General Electric Co., were recognized and rewarded Feb. 20 by the Charles A. Coffin Foundation, established in 1922. Awards of merit, consisting of a certificate and a monetary consideration, were made to 38 G.E. men representing various classes of workers and scattered among the company's various factories and offices. Seven of the recipients are shop workmen; four are foremen; one is a construction foreman; six are tool designers and expert mechanics; eleven are engineers; six are commercial men; and three are administrative employees.

PRIZES for skill as craftsmen were awarded to 16 apprentices of the Milwaukee metal trades at a dinner at the Vocational school Feb. 16. The dinner was attended by 475 apprentices and officials of machinery manufacturing plants of Milwaukee and was under the auspices of the Milwaukee Branch of the National Metal Trades Association. Harold S. Falk, of the Falk Corporation, chairman of the Association apprenticeship committee, spoke. John Roth of the Nordberg Manufacturing Co., was chairman of arrangements.

BUSINESS ITEMS

Beginning March 1, all works and offices of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., will omit Saturday operations, except an involved in maintaining service, according to an announcement by Pres. F. A. Merrick. The plan to be followed for the immediate future is to shorten the working week to the extent represented by the work normally required on Saturday throughout the company. As this reduction of service represents approximately 10 per cent, that amount of reduction will apply to all salaried employees.

The Claud S. Gordon Steel X-Ray Laboratory has been organized in Chicago to X-ray steel, iron, and metal up to a thickness of 4½ in. The laboratory is located at Western Ave. & 15th Place, Chicago, with general city offices at 708 W. Madison St., and a branch at 1988 E. 66th St., Cleveland, Ohio.

The Meany Equipment Co. has been named Portland (Ore.) representative of the Pacific Iron & Steel Co., Tacoma, Wash., manufacturer of logging and other types of machinery. Pacific Iron & Steel, formerly the Puget Sound Iron & Steel, was taken over by the Lidgerwood Company of New York several years ago.

Two new directors, C. B. Irish and L. W. Cook, Sr., were elected at the annual meeting of the Leader Iron Works, Inc., Decatur, Ill., to succeed T. E. O'Brien, who is devoting his entire time to the Leader Boiler & Heating Co., Chicago, and L. W. Snerly, who resigned because of absence from the city. Mr. Irish was made a vice-president. C. R. Walmsley was re-elected president; W. P. Stauder and William Canavan, vice-presidents; and A. G. O'Neill, secretary-treasurer.

The S. & W. Hoist Corporation, Portland, Ore., a subsidiary of the Schnitzer & Wolfe Machinery Co., Portland, has appointed distributors in Seattle and Los Anglees for the "E-Z Lift" hand hoist which is being put in production.

The Seibel Air Spring Manufacturing Co., Inc., plans to begin production late in February at the Ontario, Calif., factory building which it has taken over, according to H. Seibel, president. The company's product heretofore has been manufactured on a contract basis.

Le Sauvage & Beardsley, Genesee Bldg., Buffalo, N. Y., have been appointed direct representatives for "Lo-Hed" monorail electric hoists in the Buffalo and Rochester districts by the American Engineering Co., Philadelphia. Weed & Co., will continue to distribute Lo-Heds in Buffalo and Rochester, co-operating with Le Sauvage & Beardsley.

Organization of Miles Automatic Furnace Fans, Ltd., is announced from Ingersoll, Ont., where the company has taken factory space and started the manufacture of automatic furnace fans. The company will market them through leading furnace manufacturers and also through jobbers, furnace dealers, and heating contractors throughout Canada.

Wilson & Brown, 30 Church St., New York City, have been appointed New York territory representatives for William Sellers & Co., Philadelphia, Pa., and for the "Regal" lathes of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

The Battelle Memorial Institute, Columbus, Ohio, is sponsoring a new research project planned by the Ohio Steel Foundry Co., Lima and Springfield. The project includes a comprehensive study of steel foundry practices with a view to the developing of improvements and economies in the foundry industry. Dr. C. H. Lorig, specialist in foundry research, assisted by Clyde E. Williams will have charge of the research work.

Castings of Canada, Ltd., a recently organized company, has leased premises in Smiths Falls, Ont., and will soon commence to manufacture leakproof unions and allied fittings. Both American and Canadian capital is involved in the company, which is capitalized at $250,000.

The entire stock and goodwill of Balfour, Guthrie (Canada) Ltd., Vancouver, B. C., has now been taken over by McLennan, McFeely & Prior Ltd., Vancouver and Victoria, B. C.

The Inland Steel Co., First National Bank Bldg., Chicago, has ordered a four-high hot mill for wide strip and plates, according to a recent announcement. The new mill will be located at the Indiana Harbor Plant and will be completed and ready for operations by the close of the present year.

PERSONALS

Tell Schirnding Berna, who has been sales manager of the Union Twist Drill Co., Athol, Mass., since 1927, has been appointed general sales manager of the National Acme Co., Cleveland, effective Feb. 15.

Harry C. Beaver has resigned as vice-president and treasurer of Rolls-Royce of America, Inc. He will be succeeded by A. C. Roth and Henry S. Keyes, who will become vice-president and treasurer.

H. C. Beaver, formerly executive vice-president of Rolls-Royce of America, has been made a vice-president of the Worthington Pump & Machinery Corporation, Harrison, N. J., as of Feb. 9. On the same date, E. E. Yake was made vice-president to direct manufacturing and engineering.

Wade M. Brison, recently superintendent of the roll shop of the International Nickel Co., Huntington, W. Va., and previously with the United Engineering & Foundry Co., Pittsburgh, has rejoined United as a member of the roll and steel castings sales department.

F. H. Brownell, formerly chairman of the executive committee of the Revere Copper & Brass Co., has been elected chairman of the finance committee. George H. Allen, President, has been elected chairman of the executive committee, while Charles D. Dalls, First Vice-President, becomes president and is succeeded in his former position by William H. Pierce.

Howard Butt has been made manager of the engineering and export department of the William Powell Co., Cincinnati. Mr. Butt's heeadquarters are at 50 Church St., New York, N. Y.

Colonel B. F. Castle, formerly president of the Great Lakes Aircraft Corporation, has been elected chairman of the board of the corporation and will retire from active management.

Louis S. Cates, President of the Phelps Dodge Corporation, has been elected president of the American Institute of Mining & Metallurgical Engineers. C. M. Weld has been elected vice-president, W. D. B. Motter, secretary and treasurer. G. Temple Bridgman was the retiring president. Councilors elected were W. R. Ingalls, Lucius W. Mayer, R. A. F. Penrose, Jr., George E. Collins, W. C. Browning, and F. A. Thomson.

R. M. Chester has been appointed general sales manager of the Neely Nut & Bolt Co., Pittsburgh, Pa.

C. C. Clarke has been appointed superintendent of the new spiral welded pipe department, American Rolling Mill Co., Middletown, Ohio.

Chester G. Cummings, who has been with the New York office of the Sullivan Machinery Co., Chicago, with headquarters at Syracuse, N. Y., has been appointed manager of the Cleveland branch with headquarters in the Rockefeller Bldg., to succeed R. T. Stone, resigned.

James Darrow, Assistant Superintendent of the Waukegan, Ill., mill of the American Steel & Wire Co., completed on Jan. 8 his 35th year with the company.

Wayne Davies, formerly manager of leather sales with E. F. Houghton & Co., has resigned to joint the sales organization of J. E. Rhoads & Sons.

A. H. Dewees has been appointed manager in charge of sales of the Pittsburgh Die Casting Corporation, Swissvale, Pa., with headquarters in the Stephenson Bldg., Detroit, Mich. E. P. Burns, Jr. has been appointed Philadelphia district manager with offices at 548 Drexel Bldg., and P. L. Tolerton Chicago district manager at 844 Rush St.

George Eastman, President of the Eastman Kodak Co., Rochester, N. Y., has been made an officer of the Franch Legion of Honor, and has been made a Knight Commander of Wasa by the King of Sweden.

Harry B. Curtis, Treasurer of the Bridgeport (Conn.) Hardware Manufacturing Co., has been elected a director of the Southern New England Telephone Co. to succeed the late Augustus H. Bullard.

Robert S. Hopkins has been appointed manager of the New York district sales office of the General Cable Corporation, 420 Lexington Ave., New York, to succeed the late Harry A. Hammond.

Charles G. Jurack has joined the foundry equipment division of the Chain Belt Co., Milwaukee.

H. W. Foulds, Assistant to the President, Gould's Pumps, Inc., Seneca Falls, N. Y., has been placed in general charge of all sales work. Mr. Foulds was formerly with Servel Inc.

F. C. Engelhart was elected president of the Kester Solder Co., Chicago, at the Feb. 17 meeting of the Board of Directors. Mr. Engelhart has been the directing head of the company for 20 years, acting as general manager and treasurer. J. A. Reitzel, formerly sales promotion manager, has been elected general sales manager. The company's principal plant is at 4201 Wrightwood, Chicago.

J. E. Lawton, formerly with the Wheeling (W. Va.) Mold & Foundry Co., has been placed in charge of the recently established steel and alloy roll sales department of the Ohio Steel Foundry Co., Lima.

W. M. Levett, Vice-President and General Manager of the Welker-Hoops Manufacturing Co., Middletown, Conn., and president of the Continental Casting Co., a subsidiary, has resigned.

Col. O. S. Lyford, New York, has been elected president of the National Equipment Co., Springfield, Mass., to succeed Clifton A. Crocker, who becomes vice-president. Col. Lyford also becomes general manager and chairman of the board of directors.

Franklin J. Mayer, District Plant Manager of the Wisconsin Telephone Co., Milwaukee, has been made general plant manager for the Bell system in Wisconsin to fill the vacancy caused by the death of Leslie Killam.

David C. McKay has been elected president of the Leitelt Iron Works, Grand Rapids, Mich. F. H. Meyer was elected vice-president and general manager, Floyd V. Cederlund, secretary, and Glenn W. Sackett, treasurer. Directors are Charles B. Kelsey, chairman of the board, Leon W. Harrington and B. O. Fink, in addition to the above-named men.

J. M. McNeal, European Sales Manager of the Landis Machine Co., Waynesboro, Pa., sailed Feb. 14 for England after a 3-week visit to the home office. Mr. McNeal has his headquarters at Birmingham, England, but supervises the sale of Landis threading equipment throughout Great Britain and Continental Europe. D. F. McLaughlin, also of Waynesboro, is associated with Mr. McNeal.

W. E. Morris, for 28 years with the Puget Sound Iron & Steel Co., Portland, Ore., before the Lidgerwood company purchase, will be president and treasurer of the newly organized Pacific Iron & Steel Co. M. H. Dickinson, with the Lidgerwood company for 30 years, is vice-presdeint of the Pacific company. Stephen J. Chadwick is chairman of the board, and other directors include F. S. Fogg, Ward Estey, and M. W. McCarty. Albert Worley will remain general superintendent.

Lawrence J. Parish, Manager of Industrial Relations of the A. O. Smith Corporation, Milwaukee, spoke on "What Comprises a Well-Rounded Industrial Relations Program" at the meeting and dinner of the Industrial Relations Association of Chicago, Feb. 9.

J. A. Pelty, formerly assistant sales manager, has been appointed manager of the Salt Lake branch of the Fairbanks-Morse Co., to succeed R. M. Murray. Mr. Murray will take charge of the Diesel engine department of the company in San Francisco.

Augustus Wood, formerly chief engineer and works manager of the Niles Tool Works, Hamilton, Ohio, has returned to the company as consulting engineer. He resigned as chief engineer and works manager in 1920 and has since been works manager at the Putnam Machine Co., consulting engineer for Manning, Maxwell & Moore, and consulting engineer with the Consolidated Machine Tool Corporation.

J. G. Ordway and E. P. Mork have been elected vice-presidents of the Crane Co., Chicago.

Raymond S. Perry, formerly planning manager, Hudson Motor Car Co., has become associated with the Ingersoll Milling Machine Co., Rockford, Ill.

C. N. Ring, Asistant Director of the Electric Steel Founders' Research Group, Chicago, has resigned to take charge of development and control of shop practices for the Sivyer Steel Casting Co., Chicago and Milwaukee.

Millard Romaine, Manager of the Engineering Service Department of the Cincinnati (Ohio) Milling Machine Co., spoke on "Recent Milling Machine Applications" before the Machine Shop Practice Division of the A.S.M.E., at the Detroit Engineering Society, Feb. 16. Following this, Hans Ernst, Research Engineer of the same company, delivered a talk on "Hydraulic Applications in Machine Tools."

Carl L. Spangenberg, part owner of the Central Screw Co., Coldwater, Mich., has been appointed general manager of the Titus Iron Foundry Co., Coldwater.

Albert Troll, formerly vice-president of the Belmont Stamping & Enameling Co., New Philadelphia, Ohio, has been elected chairman of the board. W. Judkins, formerly general manager and secretary-treasurer, has been elected president and treasurer. John T. Troll has been elected vice-president and Fred F. Hall secretary.

General W. H. Tschappat, Asst. Chief of Ordnance, U. S. Army, in charge of manufacture, will speak on "Centrifugal Casting and Cold Working of Guns," at the Feb. 27 joint meeting of the St. Louis Local Section, A.S.M.E., and the St. Louis Post, Army Ordnance Association.

W. W. Weaver, formerly with the Republic Steel Corporation, Youngstown, Ohio, has been appointed superintendent of the rolling mill department, Indiana Harbor works, Youngstown, (Ohio) Sheet & Tube Co.

A. B. Wray, formerly sales manager of the industrial division, Morse Chain Co., Ithaca, N. Y., has been named chief engineer of the same division. W. W. Bertram, formerly manager of the New York office, has been appointed sales manager to succeed Mr. Wray.

OBITUARIES

Alexander Luchars, 77, mechanical engineer and founder 50 years ago of the Industrial Press, publisher of "Machinery," technical books, and technical magazines, died in Montclair, N. J., Feb. 19, of pneumonia. Mrs. Luchars died a few hours later. A more extended statement will appear in a subsequent number of *American Machinist*.

W. H. Bartram, Assistant Engineer at the open-hearth plant of the Republic Steel Corporation, Youngstown, Ohio, died Feb. 6 in an unsuccessful effort to save the life of a repairman in a gas-filled pit.

Frederick C. Brunke, until Jan. 1 Toronto manager for the United States Steel Products Co., died suddenly at Buffalo, Feb. 9.

Dwight H. Faulkner, 32, mechanical engineer, died Feb. 8 in Brooklyn, N. Y., after a long illness.

Ralph M. Friend, 66, Secretary and Treasurer of the Western Iron Stores Co., Milwaukee, Wis., died, Feb. 10 at his home following a sudden attack of illness. He was one of the founders of the firm.

Charles F. Lear, Cleveland district representative of Darwin & Milner, 1258-64 West Fourth St., Cleveland, Ohio, died suddenly Feb. 6.

Dr. John Lundie, 73, noted consulting engineer and inventor of many railroad devices which bear his name, died on Feb. 9 in New York City after an illness of several weeks.

Edward McDonald, 71, formerly secretary and treasurer of the James McDonald & Sons Co., Cincinnati, who retired ten years ago, died Feb. 18 in Cincinnati. He was widely known as an authority on metals.

John M. Paterson, Secretary of the Lysaght Dominion Sheet Metal Corporation, Hamilton, Ont., died at his home there Feb. 6.

Winfield S. Rogers, pioneer in the ball bearing industry, one-time directing head of the Bantam Ball Bearing Co., and author of "The Romance of Anti-Friction," just published, died on Feb. 18.

Henry B. Utley, 76, Vice-President and Director of the International Harvester Co., until his retirement a year ago, died Feb. 11 at Beverly Hills, Calif.

Harry M. Wallis, Sr., 69, formerly president of the J. I. Case Plow Works and the Wallis Tractor Co., Racine, Wis., died Feb. 6 as a result of injuries.

FORTHCOMING MEETINGS

AMERICAN STEEL & HEAVY HARDWARE ASSOCIATION — Annual meeting, Pittsburgh, Pa., March 18-20.

STEEL FOUNDER'S SOCIETY OF AMERICA—Sales clinic and regular meeting, March 19-20, Neil House, Columbus, Ohio. G. P. Rogers, Managing Director, 932 Graybar Bldg., New York City.

THREE-M-CONGRESS — Management, Maintenance, and Materials Handling Congress and Second National Industrial Equipment Exposition, Cleveland, Ohio, April 13-18. 1931. In the Arena and Exhibit Hall, Cleveland Public Auditorium. Information from the A.S.M.E., 29 West 39th St., N.Y.C.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, 29 West 39th St., New York. The following meetings are scheduled:

Semi-Annual meeting, Birmingham, Ala., Apr. 20-23, 1931.

National Aeronautic Meeting, Baltimore, Md., May 12-14, 1931.

National Applied Mechanics Meeting, Purdue University, Lafayette, Ind., June 15-16.

AMERICAN FOUNDRYMEN'S ASSOCIATION—Annual convention and exhibition, Stevens Hotel, Chicago, May 4-8, 1931, C. E. Hoyt, 222 West Adams St., Chicago, secretary.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION—Annual Spring Meeting, Hotel Statler, Buffalo, May 7-9, 1931. T. W. Owen, 3608 Euclid Ave., Cleveland, secretary.

NATIONAL FOREIGN TRADE COUNCIL—Annual Convention, May 27-29, at the Hotel Commodore, New York City. O. K. Davis, secretary, 1 Hanover Square, New York, N. Y.

AMERICAN MANAGEMENT ASSOCIATION—Annual Conference, Production Division, Rochester, N. Y., June 1-2, (approximate, exact dates later). Theme "Control of Manufacturing Overhead." Headquarters, 20 Vesey St., N. Y. C.

NATIONAL ASSOCIATION OF PURCHASING AGENTS—Annual Convention and Informashow, Royal York Hotel, Toronto, Canada, June 8-11. G. A. Renard, Secretary-Treasurer, 11 Park Place, New York.

AMERICAN SOCIETY FOR TESTING MATERIALS—Annual Meeting, Stevens Hotel, Chicago, June 22-26. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary-treasurer.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Annual Summer Convention, June 22-26, Asheville, N. C. F. L. Hutchinson, 33 West 39th St., New York, N. Y., secretary.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine tool business

■

BRIGHT OUTLOOKS but static sales activities characterize machinery markets. While clouds of depression are rather generally considered to be lifting, the lifting has as yet done little to assuage dealers' present difficulties. January showed an upward trend which February has failed to continue. present sales just holding their own. Inquiries continue strong, and a little more positive in tone.

NEW YORK is still marking time, though inquiries are good. Extensive metal-working projects are reported, but as yet have meant few tool sales. New England orders are principally single tools, with a large volume of inquiries which hesitate to become orders. Lathes, millers, and grinders are leading at this time. Chicago, likewise, reports little tool sale progress, railways providing most current market interest, though several lists are out. Detroit, stronghold of motordom, is more cheerful than other sections, a good indication, for other sections have been watching auto sales with fear and trembling. Cleveland's market, likewise, is better, and tool men there are optimistic as ever.

SOUTHERN DISTRICT closures are slow, present sales being only for repairs. Industrial activity there is unchanged. Milwaukee admits that the recent improvement has not continued, but agrees with Cincinnati in the statement that the low point is past. Cincinnati has a Pensylvania list. Philadelphia notices an increase in orders and inquiries, with no leaders willing to hazard a guess as to the trend. All in all, the feeling is rather generally that of a blind man grown slightly suspicious of his guiding dog, hence attempting to find his own way.

NEW YORK

Little change has occurred since last week, a few dealers reporting a pickup, several others a drop-off, and the remainder holding about even. The situation has few features, except that inquiry is a little less restricted. Large electrical companies are considering purchases of a tool or two, and a few industrials are interested. There have been no lists from railroads since the D. & H. last week. Westinghouse has reported about $750,000 worth of new business, and the railroads are planning extensive expenditures, among them the $175,000,000 program of the Pennsylvania, but these projects have as yet meant few sales of tools.

NEW ENGLAND

Sales have been at a level well abreast of January, single orders predominating. The trade has witnessed a large volume of inquiries, but placements have been curbed by rigid conservatism of buyers. An improved demand for a variety of lathes, better milling machine orders, and more interest in grinding equipment is featuring the closing days of February. It is likely totals for the shorter month will equal, if not surpass, January volume.

It is significant and encouraging that each New England State has registered industrial progress since the first of the year. Machine tool plants in New Hampshire, Vermont, Massachusetts, and Connecticut report schedule gains during that time. While the improvement has been small as a whole it indicates an upward trend.

CHICAGO

Practically no change in conditions is noted. Inquiries are mainly for single tools for replacement. Sales activity, which took a slightly upward turn during January, is unsatisfactory. Thus far this year chief interest in the machinery market has been shown by Western railroads. Additional railroad inquiry during last week is reported. The C.B.&Q. is in the market for a No. 3 Universal cutter and tool grinder; also a 5-ft. radial drill. The Union Pacific is asking for prices on a gas-engine-driven portable raill saw. The Colorado Fuel & Iron Co., Pueblo, Colo., has issued a list including a variety of tools, punches and shears principally. The Chicago Board of Education is asking bids on a No. 16 Wallace band saw, and a 6-in. jointer, needed by the Kinzie branch of the Lane Technical High School.

DETROIT

The outlook for the machinery trade continues bright. In some quarters there has been an improvement in the last ten days or two weeks and in all other sections the improvement noted early in February has at least been maintained. Dealers are all optimistic.

Not in many months has there been a period of such well-defined optimism in the motor car center. Automobile manufacturers, accessory makers, business men, bankers, machinery dealers, and others report noticeable lightening of the clouds. People are not only buying cars in greater volume than at any time in the last 12 or 14 months but they are showing a decided loosening up in other ways.

For the most part the automobile manufacturers are still conservative. They are withholding a good many orders until they have an opportunity to find out whether the gain in production is a mere flash or a real improvement. Inquiries are increasing and prospective buyers are showing a healthy interest in new equipment.

CLEVELAND

The machine tool market is considered fairly active compared to the last quarter of 1930. Sales for the past two weeks were on the same level as during the first half of February; orders were more consistent. Although they were confined to single items, the volume was just as good, and satisfactory to the trade. The feature was increased purchases by general industrialists. Although their buying has been piecemeal and conservative, it indicates that they are proceeding in a slow but sure manner and that a better feeling prevails. New inquiries show better promise.

Dealers and selling agents are unanimous in their opinions that better business prevails and that early spring will see improvement all along the line. The General Electric Co. is expected to issue a large list, early this spring, for its new $1,000,000 incandescent light plant for the Cleveland Lamp Works now under construction.

SOUTHERN DISTRICT

Machinery and machine tool sales continue quiet with little evidence of any revival in business conditions for the next few weeks. The bulk of business reported centers about equipment repairs, which take into consideration but little replacement. While hope is held out for a change that may prove helpful, there is nothing definite in the way of plans or announcements that would indicate this anticipated improvement is warranted. Sales for the most part are of a limited nature, and include small tool and equipment replacements.

Industrial activity is about the same as at the close of the year with changes limited to seasonal interruption and some plants working on better schedules. The oil fields are working on a sub-normal basis and inquiry from these points is decidedly off. Deliveries continue prompt with prices holding up all along the line. Railroad and shipbuilding business is unchanged, and the machine shops are buying only in a small way.

MILWAUKEE

The recent improvement noted here has not held up and the optimists who felt that business had really turned the corner for substantial improvement are disappointed. There are some bright spots, but on the whole reports indicate that the volume is much on the same level as it has been for several months past. There is a feeling that the corner has been turned but that improvement will be steady but slow. Orders that are being placed at present are well scattered among diversified sources, including general machinists and miscellaneous users, and are of the single-unit variety. Inquiries are not as active, but it is pointed out that this is probably due to holding off making inquiries until seriously considering placing orders to avoid the onslaught of salesmen who have been pouncing on every possible lead.

CINCINNATI

Some machine tool manufacturers note a shade of improvement in the general market; practically all see signs that the recession has reached its low point and feel that there is about to be a rebound. Local selling agents find no change in the demand but venture the opinion that a better market is beginning to develop.

The week's sales were largely confined to single tools and replacements, bought by various classes of users, located in all sections of the country. The most important inquiry of the week was a small list from the Pennsylvania Railroad. There was a fair volume of inquiries from general machinists and miscellaneous users, these being well diversified and well scattered.

PHILADELPHIA

An increase in the number of inquiries was noted by several dealers and manufacturers during the last two weeks. Most of the communications came from prospective purchasers of odd-lot equipment, but there were a few requests for prices on machine tools and some for woodworking machinery. Otherwise there were no important developments. None of the leaders of the industry would hazard a guess as to how soon there will be a revival of business.

The brightest spot in the Philadelphia area last week was the announcement of W. W. Atterbury, President of the Pennsylvania Railroad Co., that that company plans to spend $175,000,000 in the next two years in general railroad improvements.

BUSINESS • BAROMETER

Without politics to distract us, we should make a remarkable comeback during the next six months

THEODORE H. PRICE
Editor, Commerce and Finance, New York

WHEN asked for his opinion of the stock market last week, a prominent operator answered, "She is getting on an even keel again." This generalization comes about as near to describing the situation as anything recently published. A reasonable and reasoned speculation is a concomitant of economic enterprise. Men cease to find life interesting when it lacks the aleatory quality that attracts the speculators who carry the world's supply of food and raiment, to say nothing of its transportation and amusements. The experience of the last two or three years has made this plain, and if lessons of the past have any value at all for us, they should teach us not to overstay our markets. The greedy adventurers who have disregarded this lesson have nearly always lost heavily.

The recovery now in progress represents the recuperative efforts of those who suffered so severely during the decline of eighteen months ago. Most of this group have now got their second wind, and if they do not draw too heavily upon their reserves they may be able to buy back a substantial portion of the securities they have sold out. The status of the various investment trusts is a factor that should also be considered. A group of investment corporations that is controlled by a very important Chicago interest published an annual statement last week. The net resources seemed to approximate five hundred million dollars. They represent the investment work of at least a decade and attest the change that has taken place in American financial methods.

Other changes that are somewhat similar are gradually being accepted in the market for real estate loans. As yet it is hard to measure the effect that these investment novelties will have upon public sentiment. Most people are now disposed to think that the investment trust has become a permanent feature of the American money market, and the broadening demand for invsetment trust securities seems to justify this theory. Some of these investment trust securities look very cheap, and unless some cataclysm overtakes the stock market a gradual advance in the various investment trust issues would seem to be probable.

The commodity markets last week were not quite as buoyant as those of a fortnight ago. Just why commodities should have yielded as they did is puzzling. Early in the week a better feeling seemed to be manifesting itself on most of the commodity exchanges, but it did not prove to be permanent. Many observers are inclined to attribute the weakness to the threatened revolution in Spain, but in America the adequacy of this explanation is doubted, and there are many who continue to believe that the decline in silver is to blame for the recurrent weakness in so many important essentials of civilization. Those who entertain this belief call attention to the acute depression in the Orient, and insist that it will not be relieved until some method of stabilizing silver is found and put into operation.

With this exception the outlook appears to be satisfactory. President Hoover and the United States Congress seem to have agreed to disagree, and there will be no extra session. At least that is the way in which the news is generally interpreted. Hence the engineer who is at the head of our government will have abundant opportunity to elaborate and carry out his plans during the coming summer. If the amount of money at President Hoover's command is used in making the improvement for which it has been appropriated we should be certain of a boom next autumn. This prediction is, however, made with reserve, for it will not be realized unless we have comparative political tranquility during the summer. Without politics to distract us, America ought to be able to achieve a remarkable comeback during the next six months.

In the distributive trade conditions are improving. This is particularly true of the cotton goods market, where some concerns report that their mills are selling 200 per cent of their present production. It is, of course, impossible that this could be true of the whole industry, but there is a feeling of cheerfulness in Worth Street that is very encouraging to the average merchant. The same thing is true of the metal industry. The demand for steel is better than expected, and the low price at which copper was quoted has attracted buyers to such an extent that the price has been advanced to 10¼c. for domestic delivery.

The two largest automobile manufacturers are reported to be selling more cars at retail. The money market has become a little firmer, and if silver could be stabilized the cheapness of money throughout the world would have a very stimulating effect upon business.

For these reasons it seems wise for merchants to go ahead. Very few of them have stocks that can be regarded as at all normal. The shelves in our shops would be very bare if they were any longer used as they formerly were by the retail trade.

The rapprochement brought about between Gandhi and the British Government in India is very re-assuring to those who look beyond the immediate future, and the settlement of the Lancashire strike is also favorable.

THE BUSINESS WEEK

February 25, 1931

Business changes from week to week are still slight and not uniformly upward. . . . On balance January averaged a little better than December, and the first two weeks of February have shown a resumption of the rising tendency. . . . Our index has risen from the revised figure of 77.5% of normal for the week ended Feb. 7 to 78.5% (preliminary) for the latest week. . . . Steel activity continues to increase slowly; building contracts, especially in the residential field, have lately shown a fairly distinct improvement, and merchandise car loadings are doing a little better. . . . Commodity prices are somewhat steadier this week, but most other statistical indicators are still negative or non-committal. . . . Securities buyers seem disposed to stake something on the fair chance that business has been resting on a real, not a false, bottom these past two months, and the shorts are far less sure of themselves than in a long time. . . . The odds will be pretty clearly against them for the next two months unless the bulls try to discount a much more rapid business improvement than seems probable at the moment. . . . The congressional cloud is clearing, but the foreign atmosphere is still fairly foggy, and there is still no evidence of the expansion of bank credit that must precede increased construction and commercial activity by several months.

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THE WEEKLY PRICE GUIDE . . . .

Rise and Fall of the Market

FINISHED-STEEL products show more of an inclination to move than do the raw materials in current metal-market transactions. Buying continues without threat of let-up in sheets, wire, tin plate, track supplies, gas pipe-line and automotive materials. Copper and its products tend higher; tin likewise. There is, however, a poor demand for lead and zinc, the latter being the only one of the non-ferrous metals to decline perceptibly during the week. Copper sheets, wire, rods and tubing, etc., advanced ½c. per lb. at New York, Cleveland and Chicago warehouses, this week. Slab zinc is off 0.1c. per lb. at E. St. Louis.

(All prices as of Feb. 20, 1931)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI:	
Ala. Foundry (Silicon, 1.75@2.25)	$14.19@$14.69
Tenn. Foundry (Silicon, 1.75@2.25)	14.19@ 14.69
NEW YORK:	
Buffalo No. 2 Fdry. (Silicon, 1.75@2.25)	19.91@ 20.41
BIRMINGHAM:	
No. 2 Foundry (Silicon 1.75@2.25)	13.00@13.50
PHILADELPHIA:	
Eastern Pa., No. 2x (Silicon, 2.25@2.75)	18.26@ 18.76
Virginia No. 2 (Silicon, 1.75@2.25)	22.29
Basic	17.25@ 17.50
CHICAGO:	
No. 2 Foundry, Northern (Silicon, 1.75@2.25)	17.50
No. 2 Foundry, Southern	17.51
PITTSBURGH: (including freight charge, $1.76, from Valley)	
No. 2 Foundry	18.26
Basic	18.26
Bessemer	19.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00
Cleveland	4.75
Cincinnati	4.45
New York	4 75@5.00
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed*	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	1.90	3.35†	3.00	3.25†
No. 12	1.95	3.45†	3.10	3.30†
No. 14	2.05	3.55†	3.20	3.35†
No. 16	2.15	3.65†	3.30	3.45†
Black				
Nos. 18 to 20	2.15@2.25	3.60†	3.40	3.30
No. 22	2.30@2.40	3.75†	3.55	3.45
No. 24	2.35@2.45	3.80†	3.60	3.50
No. 26	2.45@2.55	3.90†	3.70	3.60
No. 28	2.60@2.70	4.05†	3.85	3.75
Galvanized				
No. 10	2.20@2.30	3.65†	3.50	3.35
Nos. 12 to 14	2.30@2.40	3.75†	3.60	3.40
No. 16	2.40@2.50	3.85†	3.70	3.50
No. 18	2.55@2.65	4.00†	3.85	3.65
No. 20	2.70@2.80	4.15†	4.00	3.80
No. 22	2.75@2.85	4.20†	4.05	3.85
No. 24	2.90@3.00	4.35†	4.20	4.00
No. 26	3.15@3.25	4.60†	4.35	4.25
No. 28	3.40@3.50	4.85†	4.70	4.50

*Light Plates. †400 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt..	56.14%	43.6%	53.3%	42.3%	57.3%	44.8%
3½ to 6 in. lap..	52.72%	40.18%	50.8%	37.8%	53.9%	41.4%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28
8	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness— Decimal	B.w.g. and Fractions	Outside Diameter in Inches— ½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot—						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or								
.125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	7.00	6.00	6.15
Hoop steel	3.75†	4.00	3.75†
Cold rolled strip steel	4.95	6.00	6.10
Floor plates	4.85†	5.30	5.00†
Cold fin., round or hexagon‡	3.40	3.65	3.35
Cold fin., flat or square‡	3.90	4.15	3.85
Structural shapes	3.10†	2.95	3.00†
Soft steel bars	3.10†	2.95	3.00†
Soft steel bar shapes	3.10†	2.95	3.00†
Soft steel bands	3.40†	3.20	3.20†
Tank plates	3.10†	3.00	3.00†
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	65%	55%	50%

*Flat, $\frac{3}{16}$-in. thick by ¾-in. wide. †400 to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse—$\frac{3}{32}$, 8.35c. per lb.; ⅛, 7.85c. per lb.; $\frac{5}{32}$ to ½, 7.35c. per lb.

METALS

Warehouse Delivery Prices in Cents Per Lb. for Small Lots:

Copper, electrolytic, New York			11.25@11.75
Tin, Straits, pigs, New York			29.00@30.00
Lead, pigs, E. St. Louis	4.30	New York	5.87½ @6.87½
Zinc, slabs, E. St. Louis	3.95	New York	5.50 @ 6.50

	New York	Cleveland	Chicago
Antimony, slabs	10.00@10.50	10.50	10.75
Copper sheets*	19.75	19.75	19.75
Copper wire*	12.00	12.00	12.12½
Copper, drawn, round*	18.25	18.75	18.25
Copper tubing*	22.12½	22.12½	22.12½
Brass sheets, high*	17.12½	17.12½	17.12½
Brass tubing, high*	22.00	22.00	22.00
Brass rods, high*	15.37½	15.37½	15.37½
Brass wire, high*	17.62½	17.62½	17.62½

*Mill, base.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%†	24.00@25.00	24.30	23.30
Zinc sheets (casks)	9.75@10.25	11.25	10.36
Solder (½ and ½)	22.00	21.50	18@20

Babbitt metal, delivered in case lots, New York, cents per lb.:

Genuine, highest grade	45.50
Commercial genuine, intermediate grade	34.50
Anti-friction metal, general service	29.00
No. 4 babbitt, f.o.b.	10.00

†F.O.B.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va.:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold drawn	50.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper	7.75	7.75	7.25@7.75
Copper, heavy, and wire	7.00	7.50	6.75@7.25
Copper, light, and bottoms	6.00	6.50	6.00@6.50
Heavy lead	3.25	3.50	3.00@3.50
Lead battery plates	1.25	2.50	2.00@2.50
Brass, heavy, yellow	4.00	4.50	4.00@4.50
Brass, heavy, red	6.75	7.00	6.25@6.75
Brass, light	3.50	3.25	3.50@4.00
No. 1 rod-brass turnings	4.50	4.50	4.25@4.75
Zinc	1.50	1.50	1.25@1.50

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13	$0.16	$0.15
Cotton waste, colored, per lb.	.09½	.12	.10
Wiping cloths, washed, white, per lb.	.15	38.00 per M	.14½
Sal soda, per lb.	.01¼	.02	.02
Roll sulphur, per lb	.028	.03	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.098	.099	.098
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.75	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.33	.36	.24
Belting—Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin.ft., per inch of width, for single ply:			
Medium grade	30–10%	30–10%	50%
Med. grade, heavy wgt.	30%	30–5%	40%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	70%	50–10%	60%
Second grade	65–5%	60–5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.031	$0.031	$0.0325
Cold fin. shafting	per lb.	.034	.034	.034
Brass rods	per lb.	.1537½	.1537½	.2125
Solder (½ and ½)	per lb.	.22	.215	.2925
Cotton waste, white	per lb.	.13	.13	.13
Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia.	per 100	4.59	4.59	4.59
Lard cutting oil	per gal.	.75	.65	.65
Machine oil	per gal.	.33	.33	.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs	off list	65–10%	65%	50–10%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*	$6.03	$6.03	$6.03
Emery cloth*	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†	2.61	2.61	2.61
Cloth†	4.59	4.59	4.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville, 2.40@2.50		
Coke, prompt foundry, per net ton	Connellsville, 3.25@4.85		
White lead, dry	100 lb. kegs	New York, 13.25	
White lead, in oil	100 lb. kegs	New York, 13.25	
Red lead, dry	100 lb. kegs	New York, 13.25	
Red lead, in oil	100 lb. kegs	New York, 14.75	

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from latest list, dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	65–10%
Larger, up to 1 x 30-in., full kegs, list less	65–10%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	65–10%
Larger, list less	65–10%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.25
Structural, round head, broken kegs, net	5.75
Tank, 7/16-in. dia. and smaller, list less	60–10%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	65–10%
Larger, up to 3-in., list less	65–10%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$3.50
Wrought, broken kegs, per 100 lb., list less	1.50
Turnbuckles:	
With stub ends, list less	20–10%
Without stub ends, list less	55%
Chain:	
Proof coil, base, per 100 lb., net	$8.50
Cast iron welding flux, per lb., net	.35
Bronzing flux, per lb., net	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

D. C., Washington — A. L. Flint, General Purchasing Officer of the Panama Canal—will receive bids until May 9 for traveling cranes, etc.

Opportunities for Future Business

Calif., Redlands—Johnston Tractor Co., H. A. Johnston, Pres., plans the construction of a 1 story plant for the manufacture of farm tractors, etc. Estimated cost including equipment $40,000.

Conn., New Canaan—City will soon award contract for a junior high school including manual training shops, etc. Estimated cost $250,000.

Ga., Atlanta—Southern Spring Bed Co., 290 Hunter St. S. E., awarded contract for addition to plant.

Ga., Austell—Clark Thread Co., 2600 Ogden St., Newark, N. J., awarded contract for the construction of a thread mill (first unit) 3 story, 498 x 133 ft., to house 40,000 spindles; 2 story, 50 x 100 ft. warehouse, 50 x 100 ft. opener room building, machine shop, and boiler room here. Initial cost $2,000,000. Ultimate total cost $12,000,000. Noted Feb. 5.

Ill., Bloomington — Sampson Oil Co., W. Brubaker, Pres., Durley Bldg., plans the construction of a 3 story, 120 x 140 ft. storage garage on Main St. Estimated cost $100,000. Architect not selected.

Ill., Galesburg—Rowe Mfg. Co., A. V. Rowe, Pres., 614 West 3rd St., manufacturers of farm implements, steel snow fence, etc. awarded contract for rebuilding 1 story, 178 x 200 ft. plant recently destroyed by fire. $45,000. Noted Dec. 25.

Ill., Plano—Reliance Battery Products Co., N. L. McMains, Pres., Council Bluffs, Ia., plans the construction of a battery plant here.

Ill., Quincy—Bd. of Education, W. E. White, Secy., Musselman Bldg., will receive bids until Mar. 12, for a 3 story high school including machine shop, manual training department, etc. at 14th St. between Main and Jersey Sts. Estimated cost $1,500,000. J. D. Chubb, 109 North Dearborn St., Chicago, Archt. Behrensmeyer & Haefner, Quincy, Assoc. Archts. Noted Feb. 19.

Ind., Evansville—National Battery Co., 501 North West Fourth St., manufacturers of electric storage batteries, will soon award contract for a 1 story service building and repair shop. Estimated cost $40,000. A. E. Neucks, Old State Bank Bldg., Archt. Noted Jan. 29.

Ind., Fort Wayne—F. Gaskins, c/o Pohlmeyer & Pohlmeyer, 260 Central Bldg., Archts., had plans prepared for a 5 story, 60 x 150 ft. garage at 124 West Washington St. Estimated cost $150,000.

Ind., Indianapolis—Eagle Machine Tool Co., 24 North Noble St., awarded contract for the construction of a factory. Estimated cost $41,000.

Mass., West Springfield (br. Springfield) — Town, J. R. Fausey, Supt. of Schools, 46 Cooper St., plans the construction of a vocational school. Estimated cost $150,000 to $200,000. Architect not selected.

Mich., Detroit—Detroit Metallic Casket Co., 2950 Gratiot Ave., awarded contract for a 1 story addition to plant.

Minn., Grand Rapids — Blandin Paper Co., awarded contract for addition to paper mill. $150,000. Total cost including equipment $900,000.

Minn., Aitkin — Minnesota State Highway Dept., C. M. Babcock, Comr., 1246 University Ave., St. Paul, plans the construction of a maintenance building. Estimated cost $40,000. Private plans.

Minn., Minneapolis—Twin City Machine Co., A. Schneider, Pres., Power Bldg., Nicollet Island, Minneapolis, awarded contract for a 1 story, 60 x 120 ft. machine shop and 50 x 50 ft. warehouse at 6th St. and 2nd Ave., S. E. C. W. Smith, 222 Essex Bldg., Archt.

Minn., Rochester — Reid Murdoch & Co., awarded contract for the construction of a 1 story, 50 x 140 ft. garage and 32 x 36 ft. work shop.

Neb., Omaha—American Smelting & Refining Co., 5th and Douglas Sts., awarded contract for the construction of a smelter building. Estimated cost $40,000.

N. J., East Rutherford — J. T. Camlet, 26 Piaget Ave., Clifton, Archt., will receive bids about Apr. 15, for a 2 story factory at 54 Mozart St. for East Rutherford Syringe Co., 75 Mozart St. Estimated cost $40,000. Noted Feb. 19.

N. J., Jersey City — B. Singer, 921 Bergen Ave., Archt., will receive bids about April 15, for the construction of a 2 story, 45 x 140 ft. factory at ft. of Crawford St., for Jersey City Ladder Co., 677 Montgomery St. Estimated cost $50,000. Noted Feb. 12.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

Everything possible is done to insure authenticity and timeliness.

Your co-operation is invited in helping us maintain this service at the highest efficiency.

BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

N. J., Newark — New Jersey Bell Telephone Co., 540 Broad St., postponed construction of 6 story garage and warehouse at Loretta Ave. and Fabyan Pl. $250,000. Architect not announced. Maturity indefinite. Noted Dec. 11.

N. J., Plainfield — Walker Turner Co., 66 York St., Jersey City, tool manufacturers, acquired the Bosch Magneto Co. plant and plans additions and alterations at South Ave. and Beekman St. here. Estimated cost $40,000.

N. J., Union City—Owner, c/o J. G. Helmers, 147 Summit Ave., Archt., is having sketches made for the construction of a 2 story garage on 14th St. Estimated cost $150,000.

N. Y., Auburn — Dept. of Correction, State Office Bldg., Albany, will receive bids until Mar. 31, for construction of storehouse for Industries, foundry and shop buildings at Auburn Prison here.

N. Y., Flushing—A. Blandel, Brookville and Conduit Blvds., plans the construction of a 2 story, 50 x 100 ft. repair shop. Estimated cost $40,000. Private plans.

N. Y., Flushing—Polk Realty Corp., 26 Court St., Brooklyn, is having sketches made for a 100 x 198 ft. service garage at 39th Ave. and 170th St. Estimated cost $65,000. J. Millman, 26 Court St., Brooklyn, Archt.

N. Y., Flushing—W. A. Walsh & Co., Bank of Manhattan Bldg., Long Island City, will build a 100 x 210 ft. service garage, and auto laundry at Dahlia Ave. and Main St. Estimated cost $70,000. A. Eccles, 29-28 Hunter Ave., Long Island City, Archt. Work will be done by day labor and separate contracts. Maturity after July 1. Noted Jan. 29.

N. Y., Jamaica—Branhill Realty Co., 163-18 Jamaica Ave., plans the construction of a 114 x 136 ft. service building at Archer Ave. and Standard Pl. Estimated cost $50,000. M. Klein, 65 Court St., Brooklyn, Archt. Maturity late fall. Noted Feb. 12.

N. Y., Jamaica — Hyman's New York and Jamaica Express, 143-01 101st Ave., is receiving bids for a 100 x 200 ft. service garage and repair shop at 165th St. and Jamaica Ave. Estimated cost $40,000. E. Guterman, 164 Montague St., Brooklyn, Archt. Noted Feb. 12.

N. Y., Long Island City—Sanitary Commission, W. Schroeder, Jr. Chn., Municipal Bldg., New York, will receive bids until Feb. 26, for the construction of a garage at 21st St. and 35th Ave. here.

N. Y., Richmond Hill—Mymand Construction Co., 6730 75th St., Middle Village, is having sketches made for the construction of a service garage at Gould Ave. and Addison St. here. Estimated cost $40,000. M. Perlstein, 6735 75th St., Middle Village, Archt.

N. Y., Tottenville—Dept. of Water, Gas & Electricity, Municipal Bldg., New York, will receive bids about Mar. 10, for the construction of a repair company service building on Joline Ave. here. Estimated cost $85,000. F. Wall, 576 Oakland Ave., West New Brighton, S. I., Archt.

N. Y., West New Brighton — J. A. Lynch, Pres., Richmond Borough, St. George, will soon receive bids for a storage and service building (truck) here. Estimated cost $60,000. F. Wall, 576 Oakland Ave., West New Brighton, Archt.

N. Y., Woodside—Mymand Construction Co., 6730 75th St., Middle Village, is having sketches made for a 100 x 125 ft. service garage at 54th St. and 39th Ave., here. Estimated cost $40,000. M. Perlstein, 6735 75th St., Middle Village, Archt.

O., Dayton — Dayton Greenhouse Mfg. Co., 939 South Ferry St., is receiving bids for a 1 and 2 story, 60 x 400 ft. and 30 x 60 ft. factory at Miami Chapel Rd. Estimated cost $75,000. Geyer & Neuffer, Ludlow Arcade Bldg., Archts. Noted Jan. 22.

Tex., Eagle Pass—Maveric County, acquired a site and plans the construction of an airport including main building, hangars, shop, etc. Estimated cost $100,000. W. L. Rockwell, Co. Engr.

Wash., Seattle—Bd. of County Commissioners, is having plans prepared for a 100 x 200 ft. hangar and 20 ft. lean-to with repair shop, etc., at Boeing field airport. Estimated cost $80,000.

Wash., Seattle—Pioneer Sand & Gravel Co., plans to expend $50,000 for a Tru-mix concrete handling plant to include wharf, bunkers, conveyor gallery, large crane and complete concrete mixing machinery at 901 Harrison St.

Wis., Milwaukee—Fitzke & Icke, Inc., 338 Davidson St., awarded contract for a 1 story, 60 x 80 ft. addition to machine shop. Estimated cost $25,000.

Wis., Waukesha—Waukesha Pattern Works, 139 North St., will soon start work on a 1 story, 40 x 80 ft. addition to plant. F. D. Chase, Inc., 720 North Michigan Ave., Chicago, Ill., Engrs.

Ont., Thorold—Ontario Paper Co., plans extensions and improvements to paper plant here. Estimated cost $500,000. Work will be done by day labor. Owner will purchase equipment.